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ABSTRACT

Intended for teachers, this monograph encourages readers to consider the notion that thinking critically is a matter of reading signs, that it is the function of signs that makes reflective thinking possible. The book contains the following chapters: (1) "Beyond a Literal Reading"; (2) "Current Thinking on Critical Thinking"; (3) "The Roots of a Semiotic Perspective: C. S. Peirce and Semiosis"; (4) Critical Thinking in Semiotic Perspective: A Process of Inquiry"; (5) "The Practice of Critical Thinking"; and (6) "Classroom Contexts for Critical Thinking." Forty-nine references and an annotated bibliography derived from searches of the ERIC database are attached. (MS)

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Number 1

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CRITICAL THINKING: A SEMIOTIC PERSPECTIVE

Marjorie Siegel
and Robert F. Carey

ERIC Clearinghouse on Reading and Communication Skills
NCTE National Council of Teachers of English
2

Critical Thinking: A Semiotic Perspective

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1989

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What Is Critical Thinking?

Critical thinking is generally believed to be a special kind of thinking that is on the decline. What sets it apart from types of thinking that might be called "uncritical" and whether it has been developed adequately seem unclear, but there is a growing consensus that thinking critically is a highly desirable behavior. Whatever critical thinking is, teachers will be expected to play a key role in developing it more successfully. Encouraging teachers, then, to think about and define critical thinking for themselves should serve that end. This series of monographs examines assumptions underlying our current understanding of critical thinking for the purposes of developing more effective instruction in reading and the other language arts.

In practice, critical thinking is an integrated performance involving lots of different kinds of thinking – although this is not the impression one would get looking at curriculum guides, in which objectives for teaching critical thinking have often been segmented to target the development of numerous discrete skills. Thus the guides ignore the complex interrelationships of aspects of critical thinking that are, at best, merely juxtaposed on lists of skills to be taught separately.

Some people, however, see critical thinking as a web of different kinds of thinking dictated and woven by the particular situation and context in which it occurs. Thinking is not just comprehending, but is a generative, "creative," knowledge-producing process. This newer definition of critical thinking would see the monographs in this series about critical thinking as themselves examples of critical thinking. Examining underlying assumptions, reaching new conclusions, and taking new action is what critical thinking is all about; and that is just what the authors of the monographs in this series aim to accomplish.

A semiotic perspective on critical thinking

Marjorie Siegel and Robert Carey hope this monograph will encourage their readers – teachers especially – to consider the notion that thinking critically is a matter of reading signs – that it is, in fact, the function of signs that makes reflective thinking possible. Since the

study of semiotics shows how signs work, Siegel and Carey are eager for their readers to take a semiotic perspective on critical thinking.

Our understanding of critical thinking is a construction of signs, which enable us to think critically about critical thinking itself. This monograph encourages its readers to do just that, beginning with the prevailing logical and "rational" analysis of critical thinking that is represented by Robert Ennis. This traditional definition recommends patterned, relatively context-free applications of thinking skills that can, if valid, be isolated and sequenced and taught.

What Siegel and Carey hope the reader will discover, however, is the semiotic perspective on critical thinking recommended by the work of American philosopher C. S. Peirce. As Peirce formulates it, semiotics provides an alternative to traditional notions of logic and consequently helps us rethink what counts as logical, critical thought.

The role of language in thinking

Whether a society was literate or illiterate is not a dependable measure of the quality of that society's thinking. What has distinguished one society from another has not been the ability to think logically, but rather the communication system used in thinking. Art was a more important communication system in some societies; dance in others; and so on. Persons in such societies used all the forms of thinking we currently use. We have a tendency to assume otherwise because we do not value some communication systems as much as we value the one that is dominant in our society – namely language.

Many persons suggest that language allows us to think completely different thoughts than persons who think in other communication systems, such as music, art, math, etc. Marjorie Siegel (1984) calls this "verbocentrism." Others question whether written language allows us to think differently than was possible in societies that communicated only with oral language. The literature refers to this as "the literacy-logic debate."

If critical thinking is not reliant on language, what role does language play in critical thinking? For one thing, language allows individuals to name their world. In naming the world, some chunk of subjective experience becomes objective. Language provides the signs that make thinking public, and it does another thing: it allows lan-

guage users to distance themselves from their knowing. Ideas can be set aside, looked at, thought about, and evaluated.

Having a theory of critical thinking in which language plays a key role opens up instructional potentials. Among key notions in such a perspective of critical thinking is that of *voice*, what students achieve when they name their world as they see it. Encouraging children to develop voice requires establishing a low-risk classroom environment, where ideas are valued. It means thinking of classrooms as communities of learners having conversations and making connections. To the student, it means being a thoughtful and responsible citizen while using oneself and others collaboratively and collectively to change one's stance in, and view of, the world.

Other monographs in this series will stress more explicitly implications of theory and research for the classroom, but Siegel and Carey indicate in Chapters 5 and 6 how a Peircean perspective is reflected in a person's everyday thinking, how it can influence the way a teacher teaches, and how it can help shape a classroom environment that encourages critical thinking and voice.

Defining critical thinking too narrowly

Instead of defining critical thinking as a special kind of thinking, the authors of these monographs argue that *all thinking is critical.* What has happened, however, they argue, is that many educators have come to regard critical thinking within a framework of limited behaviors that attempt to define some special kind of thinking. I often use some version of the following scenario to suggest how that narrow focus may have led to defining critical thinking in general and critical reading in particular as a mere set of skills:

> Researchers study some phenomenon involving language. To communicate their findings, they develop categories which describe what they believe they have seen happening. A team studying reading, for example, may say it saw readers recalling facts, summarizing, generalizing, making value judgments, etc.
>
> Eager to understand a phenomenon as richly complex as thinking, educators, publishers, and others are often only too happy to reduce it to the symptom-like behaviors that have been reported. They can (and do) translate them into a set of discrete skills for instruction. Thus these activities observed in readers become subcategories that are supposed to add up to critical

thinking while reading. Before long, they have been picked up by curriculum specialists; and shortly thereafter, new instructional programs to teach the "key skills" believed to be involved in reading critically appear on the market.

Given the problems inherent in writing about a complex process simply – even after it has been translated into various observed behaviors – such programs are inclined to order the "skills of critical thinking" in some particular fashion that makes sense to authors or editors. This encourages marketing such a program as "a new developmental program in critical thinking."

Such programs tend to generate curriculum guides replete with sequences and assessment instruments with matching subskills. Accountable teachers get on board, each type of instructional materials endorses the other, and the definition of critical thinking is confirmed. Researchers call this whole process *reification*. Labels and practices associated with the labels, not the phenomenon itself, become the object of attention.

At this point the process described above is soon apt to dictate that the mastery of "basic thinking" be taught *before* "critical thinking" because it has been logically assumed that critical thinking is only something that older children can do. That will, of course, limit what is taught to younger children.

Seeing new relationships

Despite the tendency to create a curriculum inventory of it, critical thinking remains whatever it always has been – namely, what people do in an attempt to understand and act on what they see, read, hear, feel, etc. As simple as that sounds, teachers and other educators need to think about all the factors and behaviors that process can involve. Semiotics facilitates doing this while forcing a new look because the semiotic perspective offers a fundamentally different way of thinking about thinking – one that doesn't separate thought and action. It is a rejection of behaviorist psychology and positivistic modes of inquiry, both of which guide most current conceptions of critical thinking.

This monograph's introduction to the semiotic perspective provides a thought-provoking departure for reconsidering what critical thinking is and what a better understanding of it suggests for the classroom.

– *Jerome Harste*
Series Editor

Chapter 1

Beyond a Literal Reading

Detectives are critical thinkers extraordinaire, and none is more impressive than William of Baskerville, the semiotic sleuth in Umberto Eco's tale of murder in a medieval abbey, *The Name of the Rose (1983).* Brother William noted signs continuously—reading everything around him. Like all detectives, he made sense of the world by interpreting these signs and generating hypotheses that might be worth checking out.

Besides his best-seller The Name of the Rose, *Eco's works include* A Theory of Semiotics *(1976),* The Role of the Reader *(1979), and* Semiotics and the Philosophy of Language *(1984). Widely regarded as the contemporary scholar offering the most comprehensive treatment of signs and sign functioning, Eco is equally at home analyzing the signifying power of popular culture and works of literature. He is Professor of Semiotics at the University of Bologna, Italy.*

William of Baskerville's cognitive moves are instructive and provide an apt starting point for an examination of critical thinking. We are introduced to Brother William's critical acumen early in Eco's story. A monk has been found murdered, and Brother William is called to the abbey to solve the mystery. As he and his young scribe, Adso, approach the abbey, they are surprised to meet the cellarer, the monk in charge of provisions.

It is early morning, and the cellarer is leading a party of monks and servants out beyond the walls of the abbey. Familiar with the orderly pattern of monastic life, William recognizes that the scene before him is unusual. The doubt he feels sets his inquiring mind in motion. What might this event mean? What might explain it? He has already begun to interpret the evidence around him when the cellarer stops to greet him. William responds with the following observations:

> "...and I appreciate your courtesy all the more since, in order to greet me, you have interrupted your search. But don't worry. The horse came this way and took the path to the right. He will not get far, because he will have to stop when he reaches the dungheap. He is too intelligent to plunge down that precipitous slope...."
>
> "When did you see him?" the cellarer asked.
>
> "We haven't seen him at all, have we, Adso?" William said, turning toward me with an amused look. "But if you are hunting for Brunellus, the horse can only be where I have said." The cellarer hesitated. He looked at William, then at the path, and finally asked, "Brunellus? How did you know?" (p. 23)

How did Brother William know that the cellarer was searching for a horse? This is the very question young Adso asks, as the horse is

found and led back to the abbey. William's reply reveals his central attitude:

> "My good Adso," my master said, "during our whole journey I have been teaching you to recognize the evidence through which the world speaks to us like a great book." (p. 23)

Charles Sanders Peirce, who is recognized as the key figure in modern American semiotics, proposed that "the entire world is perfused with signs, if it is not composed exclusively of signs." (cited in Sebeok, 1977, p. vi).

Like his iconic colleague, Sherlock Holmes (see Eco and Sebeok, 1983), William of Baskerville understands that a literal reading of the world will not solve the crime. His rejection of literal thinking is based on the assumption that the world is "perfused with signs" – that a broken branch and tracks in the snow do not point to themselves but to something else – an animal perhaps.

This is the essential function of a sign – to bring something other than itself into one's awareness; to show what the "evidence" might be evidence of – its meaning. But it is the appearance of the cellarer that sets Brother William's attitude of inquiry in motion. He uses his perceptions of the broken branch and tracks in the snow, along with his knowledge of monastic life, to arrive at an hypothesis that might explain why the cellarer is roaming the woods outside the abbey. Together, his understanding of signs and his use of abduction – the logic of discovery or hypothesis generation – makes him a *semiotic* sleuth. He was moved, Adso tells us, "by the desire for truth, and by the suspicion – which I could see he always harbored – that the truth was not what was appearing to him at any given moment." (p. 14)

"Semiotics is the study of signs of all kinds. A sign is something that stands for something else." (Suhor, 1984, p. 247)

Critical thinking as reflective skepticism

Adso's summary highlights two important aspects of critical thinking: skepticism and reflection. William of Baskerville does not take his perceptions for granted. Because he knows that he lives in a world of signs, he approaches it with a skeptical attitude. At the same time, he does not doubt everything. Notice that it is only when he encounters an anomaly that he begins to reflect on the significance of the cellarer's actions. Reflection allows him to consider various explanations for these actions and, in so doing, move beyond a literal reading.

Critical thinking, as Brother William practices it, thus requires a judicious mix of skepticism and boldness. Perceptions may be questioned, but eventually an hypothesis, however bold it might seem, must be produced. Risk-taking is central to critical thinking, for an hypothesis that is never generated can never be tested. Brother Wil-

liam shows us that critical thinkers must ask two questions: Why? and Why not?

The skeptical and reflective attitude that Brother William exhibits characterizes recent definitions of critical thinking (Cornbleth, 1985; McPeck, 1981). For example, Cornbleth offers the following definition:

> The *essence of critical thinking is informed skepticism*, a trusting, yet skeptical orientation to the world. It is active inquiry rather than passive acceptance of tradition, authority, or "common sense." (p. 13)

McPeck (1981) defines critical thinking as reflective skepticism. He says, "This skepticism might ultimately give way to acceptance but it does not take truth for granted. Instead, it considers alternate hypotheses and possibilities." (p. 6)

She continues:

> Critical thinking involves *questioning the ideas* we encounter. It is, therefore, a dynamic process of questioning and reasoning, of raising and pursuing questions about our own and others' claims and conclusions, definitions and evidence, beliefs and actions. (p. 13)

This definition and the one proposed by McPeck are consonant with Brother William's approach to critical thinking, and, we would argue, would be strengthened if their semiotic grounding were made explicit. What we hope to show is that critical thinking is a process of reasoning through signs.

The work of Charles Sanders Peirce, the American pragmatist credited with the development of semiotic thought in modern times, is especially useful here. Peirce was a scientist who was also devoted to understanding the process of inquiry. Concepts such as skepticism, reflection, and reasoning were cornerstones of his theory of inquiry and as such can serve our goal of understanding the nature of critical thinking.

A summary of current views of critical thinking will ground a discussion of the relationship between Peirce's ideas and aspects of critical thinking. We can then examine critical thinking in the context of everyday life and conclude with some comments on what a semiotic perspective might suggest for instruction.

These photos of Charles S. Peirce and that on the cover are used by permission of the Houghton Library, Harvard University, Cambridge, Massachusetts.

Chapter 2

Current Thinking on Critical Thinking

Most educators would agree that critical thinking is a worthy educational goal. There is less agreement, however, on how to think about critical thinking. For some, critical thinking is a set of discrete skills that can be used to evaluate statements in any discipline. For others, critical thinking is a continuous process of reflection that occurs in purposeful, domain-specific contexts.

These two perspectives on critical thinking will have a familiar ring to reading and language educators. The first position is similar to the basic skills argument that some reading educators make: break reading down into component skills that can be directly taught and mastered by learners. The second position has more in common with a transactional model of reading in which comprehension arises from the interplay of reader, text, and context.

Louise Rosenblatt presents a transactional model of the reading process in her classic, The Reader, The Text, The Poem *(1978). This work draws on the thinking of C.S. Peirce and John Dewey.*

Approaching critical thinking through logic

The debate over critical thinking centers around the attempt by some scholars to define it in logical or rational terms. Stated in these terms, the goal of critical thinking becomes sound reasoning. A task analysis of this process results in a list of discrete skills which, when applied step by step, would assure sound reasoning.

Robert Ennis' paper "A Concept of Critical Thinking" (1962) is frequently cited as an example of this sort of analysis. It was one of the first attempts to offer a concept precise enough to serve as the basis for research on teaching and evaluating critical thinking. Ennis went on to develop and later revise the *Cornell Critical Thinking Test* (1961, 1971), and other educators have developed curricula based on his list of critical thinking skills.

An interesting extension of Ennis' development of a test for critical thinking is described by Deanna Kuhn (1986). She notes that the Educational Testing Service relied on Ennis' test for an initial pool of items when it developed a third subtest of the Graduate Record Exam to assess "analytic" thinking aptitude.

Recently, however, the analysis Ennis worked out has been assailed as fundamentally flawed. Critics (*e.g.*, Cornbleth, 1985; McPeck, 1981) argue that this set of skills misses the character of critical thinking. The claim is that critical thinking is more an attitude than a collection of

skills and, further, that it requires knowledge of the particular domain to which the thinking is applied.

Although an attempt to move beyond behavioristic accounts of thinking, Ennis' work exemplifies the behavioristic context in which it appeared. It provides a common reference point for much of contemporary work in critical thinking.

A review of Ennis' description of critical thinking is necessary before summarizing the criticisms McPeck and others make of Ennis' "basic skills."

Writing in 1962, Ennis argued that research on thinking had ignored critical thinking. Psychology was still in the grip of behaviorism in those days, resulting in an emphasis on associative thinking over other forms of thinking. Hence, Ennis turned to logic to provide educators with a "comprehensive and detailed examination of what is involved in making judgments about the worth of statements or answers to problems." (p. 82) Logic was to provide the rules for correct reasoning.

Contrast these procedures with the data-based manipulations used by Gardner (1983) in his work on intelligence.

Ennis used the following procedure to develop a comprehensive concept of critical thinking: 1) examine the literature on the goals of the schools and also the literature on the criteria for good thinking; 2) select from this literature those aspects which come under the heading of critical thinking, defined as the correct assessing of statements; 3) elaborate the criteria for making these judgments; 4) simplify the result by classifying some aspects under others that are logically more basic; and 5) simplify this list further by logically analyzing them into basic factors or dimensions of critical thinking (pp. 82-83). The result of this task analysis was a list of 12 "aspects" of critical thinking culled from the literature on informal logic:

1. Grasping the meaning of a statement.
2. Judging whether there is ambiguity in a line of reasoning.
3. Judging whether certain statements contradict each other.
4. Judging whether a conclusion necessarily follows.
5. Judging whether a statement is specific enough.
6. Judging whether a statement is actually the application of a certain principle.
7. Judging whether an observation statement is reliable.
8. Judging whether an inductive conclusion is warranted.
9. Judging whether the problem has been identified.
10. Judging whether something is an assumption.
11. Judging whether a definition is adequate.
12. Judging whether a statement made by an alleged authority is acceptable. (p. 84)

In addition, Ennis presented three dimensions along which these aspects of critical thinking could be simplified: the *logical* dimen-

sion, the *criterial* dimension, and the *pragmatic* dimension. These dimensions will be examined later in this chapter.

Although Ennis acknowledged that some logic books were as comprehensive as his own work, he maintained that none attempted to simplify the various aspects of critical thinking into some basic factors. Ennis claimed it is this attempt to simplify the dimensions of critical thinking that allows for the development of a concept that may serve as a basis for research on the teaching and evaluation of critical thinking abilities.

Challenges to logical analyses

Ennis' program for developing a concept of critical thinking has a number of features that have been challenged by current work on this topic. First, he sought a concept of critical thinking that was *precise* enough to be tested empirically. For example, he suggests that the list of 12 aspects of critical thinking he offers could be used to construct a table of specifications for tests of critical thinking.

Indeed, Ennis viewed his work as an attempt to move beyond the "vague" description of reflective thinking that John Dewey outlined in his classic *How We Think* (1910, 1933). The fact that scholars like Cornbleth (1985) have returned to Dewey's ideas indicates that researchers have abandoned their quest for the precise skills Ennis hoped to identify. Instead, most scholars argue that thinking is a complex process involving beliefs, knowledge of the relevant domains, and context. There is no scope and sequence chart for thinking as Dewey defined it.

Consider Dewey's characterization of thinking as "the various ways things acquire significance." (1910, pp. 28-29)

Second, Ennis was aiming for a *comprehensive* definition, one that would cover all cases in which statements were to be judged. He viewed his list of 12 aspects of critical thinking as ways to "avoid pitfalls" in assessing statements. The implication is that there are general "rules" people can follow to correctly judge statements and that these rules can be applied according to the norms and standards of various knowledge domains and contexts.

Here we encounter what appears to be a paradox in Ennis' approach. The search for precision leads him to identify a list of 12 critical thinking skills that seem to be content- and context-free. At the same time, the search for comprehensiveness leads him to incorporate subject matter knowledge and context into this list by explicating the

criterial (by which he means the rules of judgment that have been established by various disciplines) and pragmatic dimensions of the 12 skills. Nevertheless, the rules of logic remain the cornerstone of his concept of critical thinking, as will be shown in the following section.

The logic of critical thinking

The notion of a "content-free syntax" has long fascinated logicians. The idea may well have reached its apex in the work of Whitehead and Russell (1910).

Logicians are interested in methods of reasoning. Their goal is to develop methods that yield true and reliable knowledge in the form of statements of this sort: "All objects made of wood float." Ennis proposes that grasping the meaning of a statement such as this one is the basis for all other aspects of critical thinking.

He explains that grasping the meaning of a statement involves knowing what would count as evidence for and against it, and what statements would contradict it. The sort of reasoning implied in this description depends on knowledge of the relevant subject matter. And yet Ennis emphasizes the logical dimension only, weighing more heavily the syntax rather than the semantics of statements.

This emphasis on logic over beliefs, subject matter knowledge, and context can be seen in Ennis' discussion of the fourth aspect of critical thinking—judging whether a statement follows necessarily. He notes that this aspect is most often referred to when logical reasoning is mentioned. The logical requirement of this sort of reasoning (called *deductive, syllogistic,* or *"if-then"* reasoning) is stated: "A conclusion follows necessarily, if its denial contradicts the assertion of the premises." (p. 87) Ennis then goes on to list the rules of logic that have been developed for different types of deduction:

> 1. The rules for handling equations and inequalities.
> 2. The rules of "if-then" reasoning, such as: Denial of the "then-part" requires denial of the "if-part," but not necessarily vice versa.
> 3. The rules for categorical reasoning, which may be summarized as follows: Whatever is included in a general class is included also in whatever that general class is included in, and is excluded from whatever that general class is excluded from. (pp. 85-86)

The spirit of Ennis' approach is captured in his concluding comment on this aspect of critical thinking. He writes:

> This aspect extends along the logical dimension only. There are no extenuating circumstances. Either a conclusion follows ne-

> cessarily or it does not. It is partly because these decisions can be so carefully and neatly systematized that deductive logic is given so much attention in logic courses. (p. 86)

The dominant theme in this passage is the application of precise, general rules. Judging the relationship between a premise and its conclusion is a straightforward process that does not vary across situations. Despite Ennis' insistence that meaning is the core of the process, one gets the feeling that it is the shape of the argument that is most central.

Ennis attempts to include the role of the relevant knowledge domain and context in his "dimensional simplification." As noted above, Ennis hoped to simplify the list of critical thinking skills by examining them in light of three dimensions: the logical dimension, the criterial dimension, and the pragmatic dimension. The logical dimension is concerned most directly with judging the relationship between words and statements. Ennis suggests, for example, that persons competent in this dimension will know how to use logical operators like *all, some*, and so on, as well as the meaning of basic terms in the discipline to which the statement pertains.

Again in contrast, consider Dewey's contention that the intellectual nature of a subject stems not from its "inner structures" but from its function (1910, 1933).

The criterial dimension involves knowing the criteria, derived from various disciplines, by which to judge statements. For example, the eighth aspect of critical thinking is judging whether an inductive conclusion is warranted. A simple generalization about experience is one such situation. Ennis lists four general rules which would be called into use in judging whether a generalization about experience were warranted. These rules include knowing how to adequately judge samples (*e.g.*, the need for unbiased samples), knowing that a bulk of reliable instances is needed, and knowing that there can be no counter instances. The fourth rule states explicitly that the generalization is warranted if it fits into the larger structure of knowledge. Hence, disciplinary knowledge is acknowledged as a prerequisite for some aspects of critical thinking.

Finally, the pragmatic dimension involves a judgment call with respect to the purpose for judging the truth of the statement. The critical thinker must decide whether a statement is "good *enough* for the purpose." (p. 85) An example of the pragmatic dimension is provided in Ennis' discussion of how to judge whether a statement is specific enough. He says that the statement "Education has disappeared from the schools" is not clear enough if the purpose is to decide upon a

It is interesting that Ennis perceives the goal of logic as arriving at a binary solution — a yes-no answer.

school district's budget. But in a war-torn country, this statement may be specific enough to report to the country's leader (p. 86). This example suggests that critical thinking is more context-dependent than initially suggested by the list of critical thinking skills.

McPeck begins his critique of Ennis' concept of critical thinking by proposing that logic may be a necessary condition of critical thinking, but it is not a sufficient one. McPeck's point is that logic plays a relatively minor role in critical thinking when compared to knowledge of a specific field. In other words, McPeck believes that a critical thinker would not be able to follow the rules of logic Ennis presents unless he or she had a good working knowledge of the particular domain. Indeed, McPeck claims that the logic people use when judging specific statements is defined by the knowledge domain and is not independent of it. The fact that Ennis explicates some of the skills on his list without including the criterial and pragmatic dimensions suggests that for Ennis logic is primary in his concept of critical thinking, whereas domain-specific knowledge and context are secondary.

McPeck then points out the irony of Ennis' work, namely, that his most original contribution to understanding critical thinking—the three dimensions of the concept—is also responsible for the inadequacy of his definition. By including various dimensions, Ennis shows that critical thinking cannot simply be a matter of having certain skills (the 12 aspects of critical thinking he lists); each of the three dimensions illustrates how skills must be used *in conjunction with the relevant content and contextual features of a situation*, that is, with the purpose and meaning of the statement to be evaluated in mind. But if the contextualized nature of critical thinking is taken seriously, then a general procedure for the correct assessing of statements cannot be specified. Thus, Ennis' definition collapses in on itself.

It is as if Ennis was aware of the limitations of a general procedure and so tried to qualify it, while still retaining the general character of the model. McPeck's argument is that a fundamentally different approach is needed, one which places domain-specific knowledge rather than logic at its core.

The centerpiece of McPeck's argument is that domain-specific knowledge is required in each of the dimensions identified by Ennis. First, the logical dimension proposes that a person must judge the relations between words and statements. Ennis admits that the words and statements must be understood if a statement is to be judged, and Mc-

Peck emphasizes that such judgments depend on an understanding of the specific domain of knowledge.

The second dimension of critical thinking, the criterial dimension, is also linked to knowledge of a particular field. McPeck's argument regarding the criterial dimension is that it is defined in terms of the standards used to evaluate statements in particular domains of knowledge; and since there are numerous domains, each with its own standards of assessment, the criterial dimension cannot establish a set of skills that will apply to any and all knowledge domains.

The role that domain-specific knowledge plays in the workings of the pragmatic dimension makes it clear that Ennis' list of critical thinking skills could not actually contribute to the correct assessment of statements. McPeck points out that the pragmatic dimension involves "judging, in context, when one has 'enough' evidence in light of the statement's purpose and practical consequences" (p. 49); and he concludes:

> In effect, the pragmatic dimension places critical thinking squarely in the arena of an infinity of possible kinds of judgments with an infinite number of possible consequences. This is because the purpose and contexts of assertions vary independently and unpredictably. (p. 51)

This is a clear rejection of critical thinking as a context-free activity. Critical thinking, for McPeck, is always thinking about something in some context for some purpose. Therefore, the correct assessment of statements cannot be specified and cannot, in the end, define critical thinking (McPeck, 1981).

It should be noted that Ennis was working well within a tradition of post-war logical studies and very early cognitive science. In many ways, he represented the mainstream of conventional academic psychology and pedagogy.

New definitions of critical thinking

These criticisms of the "basic skills" approach to critical thinking have been echoed by others (*e.g.*, Cornbleth, 1985; Kuhn, 1986; Perkins, 1985). Among these scholars, there is some agreement that critical thinking is "informed skepticism" (Cornbleth, 1985) or "reflective skepticism" (McPeck, 1981).

The emphasis on skepticism, reflection, and domain-specific knowledge in these definitions is an attempt to capture the dynamic and complex nature of critical thinking. These writers propose that critical thinkers are better equipped with a skeptical attitude than with rules on how to avoid pitfalls in thinking.

Whereas Ennis takes skepticism for granted (*i.e.*, judging statements presumes there is some doubt that they are true), this attitude is central to the definitions cited above. Deciding that a statement should be critically scrutinized may be more important (and more difficult to teach) than the actual analysis (Sternberg and Martin, 1988). And, of course, making such decisions depends on knowing the subject matter. We can only recognize nonsense against a background of meaningfulness.

One important hallmark of modern intellectual history has been the general critique directed toward "formalism" in psychology, literature, and the arts and humanities in general. Questioning the more normalized aspects of logic rules and/or "basic skills" is an extension of this tradition.

The importance of focusing on the attitude and subject matter knowledge of critical thinkers becomes clear when the issue of transfer is considered. It would be hard to find a teacher who did not believe that the goal of instruction is to help students transfer whatever skills are being taught in school to situations encountered outside of school. And yet, transfer effects have been elusive – the bane of most instructional programs aimed at developing thinkers. Scholars promoting a new definition of critical thinking agree that this "transfer dilemma" (Kuhn, 1986) will not be resolved if critical thinking is defined as a list of general skills, as Ennis does; it can only be addressed by examining the actual process of thinking (critical or otherwise) in everyday contexts. The concern, in other words, is that students will not use what they've been taught about critical thinking if it bears no relation to the sort of thinking required in out-of-school situations.

Further limitations of logic

Here another drawback of a narrowly conceived and universally applied view of logic becomes apparent. For example, in "everyday cognition," thinkers are rarely concerned with the truth value of *statements*; instead, they encounter decisions to be made, problems to be solved, and the like. Moreover, "truth" is rarely the goal in everyday cognition. As Johnson-Laird (quoted in Gardner, 1985) notes, "The kinds of logic described by logicians simply seem irrelevant to normal individuals. We do not construct truth tables and look up the result: we do not use formal rules of inference." (p. 362) Evidence from a number of ethnographic studies (Murtaugh, 1985; Scribner, 1984) suggests that in the ill-structured, purposeful world of everyday cognition, human thought is practical and opportunistic. In a statement reminiscent of Ennis' pragmatic dimension, Rogoff (1984) says:

> [T]hinking is a practical activity which is adjusted to meet the demands of the situation. As such, what is regarded as logical

> problem-solving in academic settings may not fit with problem-solving in everyday situations, not because people are "illogical" but because practical problem-solving requires efficiency rather than a full and systematic consideration of all alternatives. In everyday situations, thought is in the service of action. Rather than employing formal approaches to solving problems, people devise satisfactory opportunistic solutions. (p. 7)

Logic, in the traditional sense of the term outlined thus far, fails the critical thinker in one more important regard, and that is in *generating* hypotheses. McPeck (1981) notes that logic can help eliminate hypotheses but not provide them (*cf.*, Perkins, 1985). McPeck continues, "In the most common problem-solving situations within disciplines and working fields of knowledge, the most difficult—and perhaps most important—phase is that of producing a hypothesis...that is worth checking or trying out." (p. 15) Scientists and detectives, who are usually held up as examples of critical thinkers, often argue that the key to their work is the proper framing of the problem as an hypothesis. Once that is accomplished, the solution is not long in coming.

The story of how DNA was actually discovered is told by Nobel Prize winner James Watson in The Double Helix *(1968). Ludwig Fleck's treatise on the social construction of scientific facts (1935, 1979) is also informative about the process of inquiry.*

One way to summarize the criticisms of Ennis' work is to say that he failed to capture critical thinking as people actually use it. Dewey (1933) himself recognized the limitations of a logical analysis of critical thinking. He wrote:

> [Logical] forms apply not to *reaching* conclusions, not to *arriving* at beliefs and knowledge, but to the most effective way in which to set forth what has already been concluded so as to convince others...of the soundness of the result. [*emphasis added*] (p. 74)

From Dewey's perspective, the 12 aspects of critical thinking Ennis proposed would not constitute the process of critical thinking; they represent the product of such thought. Dewey concluded:

> The logical forms that characterize conclusions reached and adopted cannot therefore *prescribe* the way in which we should attempt to arrive at a conclusion when we are still in a condition of doubt and inquiry. [*emphasis added*] (p. 75)

Current work on critical thinking suggests that limiting it to a set of logic rules will produce a concept of critical thinking that is easily measured but inadequate in practice. Educators must be wary of definitions of critical thinking that create yet another gulf between what children are taught in school and what successful critical thinkers do in the context of daily tasks. Language educators in particular are already

too familiar with this gap; witness the "Friday spelling test" syndrome in which children who can spell the words on the test have no strategies for solving spelling problems encountered in the course of purposeful writing.

The definitions put forth by McPeck and Cornbleth hold more promise for educators than Ennis' definition. In describing critical thinking as a reflective process motivated by skepticism and carried out in the context of a particular knowledge domain, they seem closer to capturing what critical thinkers, like scientists and detectives, seem to do. But without a clear understanding of the nature of reflection and skepticism, there is a danger that these concepts will be regarded as "fuzzy," inadequate for the purpose of curriculum building. Educators will need to defend instructional settings that foster "reflective skepticism" against those who would prefer a more precise and, hence, "teachable" and "testable" critical thinking curriculum.

Semiotics offers one framework within which to clarify the meaning of terms like *reflection* and *skepticism*. In addition, the semiotics of Charles Sanders Peirce conceives of logic in such a way as to connect it to the practice of critical thinking. Some background on semiotics will provide the basis for considering reflection, skepticism, and logic from a semiotic perspective.

Chapter 3

The Roots of a Semiotic Perspective: C. S. Peirce and Semiosis

"It would be easy," Thomas Sebeok (1986) tells us, "to get the notion that semiotics, which is now a chic undertaking in and out of the academy, is a brand new subject born in the last fifteen years or so." (p. 14) But, in fact, the central concerns of semiotics – meaning, knowledge, cognition – date back to the Greeks and were given their current shape by John Poinsot, an Iberian philosopher who published *A Treatise on Signs* in 1632 (Deely, 1981, 1982; *cf.*, Sebeok, 1986).

In this century, thinkers such as linguist Roman Jakobson and philosopher Susanne Langer have been associated with semiotic themes. Each explored questions related to the nature and use of signs in communication and cognition. Scholars in disciplines as diverse as anthropology, architecture, and art history have refigured their objects of study so that the exchange of meanings through signs is the central concern.

Semioticians thus cast a wide net. To them, all cultural phenomena are essentially processes of producing and interpreting signs (Eco, 1976). To them, the use of signs is so much a part of the human condition that we are most properly classified as "*Homo symbolificus*, man the symbol-monger." (Percy, 1982, p. 17)

Peirce taught logic at Johns Hopkins University but was never offered a professorship. Some suspect this was the result of his personality and marital difficulties, but most writers suggest that his perceptions were just too original for academicians of his day. (Denison, 1985; Fisch, 1977; Jakobson, 1985)

The seminal work of C. S. Peirce (1839-1914) provides the basis of much of what follows. Peirce was a contemporary of William James and John Dewey and, along with them, is credited with the rise of the American school of philosophy known as *pragmatism*. It is only recently, however, that Peirce's work on semiotics has circulated outside a small circle of specialists. His ideas never achieved prominence during his lifetime. Scorned by the academic community of his day, he died penniless and relatively unpublished. Yet, he has come to be recognized as "the most original philosopher our country has so far produced." (Fisch, 1977; *cf.* Skagestad, 1981) And, though his work on signs was carried out almost 100 years ago, it provides the starting point for contemporary treatments of semiotic problems.

The concept of reflection

Peirce, Dewey, and other major semioticians all emphasize the idea that thought and belief are important in so far as they are preludes to action. Reflection, to them, is the hallmark of the ethical, "examined" life. It is not a trivial, or passive, notion.

Semiotic themes surface in current definitions of critical thinking in the form of the concept of *reflection*. Reflection is usually described as a matter of stepping back from whatever has been taken for granted (a fact, a decision, a problem) and examining the evidence or basis for its acceptance. For example, McPeck (1981) argues that "Critical thinking, by contrast [to knowledge based on authority], requires knowledge of the reasons that lie behind the putative facts and various voices of authority." (p. 157) This statement suggests that critical thinkers do not accept facts at face value; instead, they challenge the status of facts as given.

Critical thinkers are not satisfied with knowing just the outcome of someone's reasoning; they want to examine the basis for the fact or decision. In a sense, then, critical thinkers look back. They look back to see what the basis for this fact or decision might be and how it came to be accepted as reliable knowledge. But reflection is not solely a matter of looking back to scrutinize a line of reasoning. It also entails a look forward to see what a fact or decision might indicate beyond itself—what its consequences might be, what it might point to or *signify*.

The claim that critical thinkers reject literal thinking means that, like William of Baskerville, they are not quite sure that the truth is what is appearing to them at any given moment. And questioning the reliability or truth of something calls for an exploration of the meaning it might come to have if it is acted upon. To restrict reflection and ultimately critical thinking to examining only the bases for claims, limits critical thinking to the use of past tense. The actual use of cognition in daily life is characterized by meaningfulness, action, and a consideration of potential consequences. It exhibits a tendency toward the use of future tense, as Rogoff (1984) and others have shown. Hence, critical thinkers must consider where their conclusions might take them as well as where these conclusions came from.

Cornbleth (1985) shows that this perspective on reflection is grounded in the work of John Dewey. She notes that Dewey took reflective thought to be an "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends." (Dewey, 1933; quoted in Cornbleth, 1985, p. 13) Dewey's description of reflection involves the movement forward to possible conclusions as well as

the more traditional movement back to uncover the grounds or bases for some form of knowledge. This simultaneous movement forward and back in reflective thought is made possible by the signifying function. In other words, understanding the way in which one thing signifies or stands for another is central to understanding reflection and, consequently, critical thinking.

The signifying function

Dewey explains the signifying function by noting how a dark cloud brings to mind the possibility of rain and thus "The seen thing is regarded as in some way the *ground or basis of belief* in the suggested thing; it possesses the quality of evidence." (p. 10) He continues:

> This function whereby one thing signifies or indicates another, thus leading us to consider how far the one may be regarded warrant for belief in the other, is, then, the central factor in all reflective or distinctly intellectual thought. (p. 10-11)

Dewey is making a connection between how something may serve as the warrant for a belief with how something may serve as a sign for something else. To make this connection, Dewey draws on Peirce's description of how signs work and how meaning or significance is established. In this way, Dewey serves as the conceptual bridge between contemporary ideas about critical thinking and the work of Peirce. Peirce provides an account of sign-functioning, a process he called *semiosis*. This process explains how one thing can signify or stand for another.

Some of Peirce's letters contain cogent explanations of his analysis of signs. His correspondence with Victoria Lady Welby, an Englishwoman interested in the problem of meaning, has been published in Semiotic and Significs *(Hardwick [Ed.], 1977).*

Semiosis: The triadic relation

A proper understanding of semiosis begins with Peirce's definition of a sign: "A sign is something which stands to somebody for something in some respect or capacity." (quoted in Eco, 1979, p. 180) This definition clearly states that the sign is a triad, that is, the sign has three components, none of which can be considered apart from the others. (See Figure 1.)

Figure 1: The Semiotic Triad

The triadic nature of a sign can be illustrated by a preschooler's response to a piece of environmental print. Nathan, age 3, was shown a carton of Crest toothpaste and asked what it said. He responded, "Brush teeth." (Harste, Woodward, and Burke, 1984) From the perspective of Peirce's definition of a sign, we could say that a sign (the

configuration of print and graphics on the carton) stood for something (Crest toothpaste) and in some respect (brushing one's teeth).

Semiotics deals with meanings and messages in all their forms and in all their contexts. (Innis, 1985, p. vii)

At first it may seem superfluous to think of a sign as having three components rather than two; the most common understanding of a sign is that one thing stands for another (signifier-signified; symbol-concept). Why isn't it adequate, for example, to simply say that the print setting of a Crest carton signifies brushing one's teeth? A response based on Peirce would be that a dyadic relationship could only describe how one thing relates to another in a mechanical way and would say nothing about the most important characteristic of signs, namely their ability to indicate some aspect of the *meaning* of that relationship.

In other words, the significance of a triadic as opposed to dyadic relation is that the representation of the object and the interpretation of the object are coupled in one dynamic relation. Peirce accomplishes his goal by proposing that the "standing-for" relationship results from the mediating function of the *interpretant*, another sign, as well as the third part of the triad. One thing stands for another in terms of a third (the interpretant).

Note that the interpretant *is another* sign. *It is neither the* interpretation *nor the* interpreter. *Rather, it is an integral part of the process of meaning.*

For Nathan, "brush teeth" functions as the interpretant; it's an already existing sign that he uses to connect the print setting of the toothpaste carton and Crest toothpaste. Stated another way, a sign is not simply a substitute for something but shows up some aspect of the meaning of that thing. ("A sign is something which stands to somebody for something *in some respect or capacity*." [emphasis added]). Eco (1984) explains this point in the following way:

> Thus substitution...is not the only necessary condition for a sign: the possibility of *interpretation* is necessary as well. By interpretation...we mean the concept elaborated by Peirce, according to which every *interpretant*, besides translating the...content of the sign, also increases our understanding of it. (p. 43)

Nathan could therefore be said to be translating the Crest toothpaste carton as "brush teeth" and, as Eco might note, it is likely that his response increases his understanding of the sign. Clearly, the signifying function, or *semiosis*, has a generative impulse to it that opens up possible meanings. The key point here is that the interpretant should not be reduced to the representation of the object; "toothpaste" is not the only possible interpretant. Others might be "dentist," "mint-flavored," or "bedtime." Each of these possible interpretants contributes

to the interpretation of the sign's meaning in a particular situation. This range of interpretants also indicates that sign interpretation is bound up with our actions in daily life. As Peirce noted, our world is perfused with signs. We live in a symbolic world – a world of meaning and action – and so context is embedded in the process of sign interpretation. Considered in this way, semiosis lays the foundation for a view of critical thinking in which meanings can be opened up as well as closed down – that is, critical thinking as both the creation and evaluation of knowledge.

The implications of semiosis for critical thinking

To summarize thus far, understanding semiosis is important for several reasons. First, semiosis shows that our knowledge of the world is mediated. We don't just encounter shapes and sounds; we encounter a world made meaningful through the mediation of interpretants – networks of signs. Since we do not have direct knowledge of the world – since we know the world only through signs – we cannot expect that critical thinking will lead us to *true* knowledge.

Second, the triadic nature of the sign suggests that meaning is not reducible to the sum of its parts. Peirce insisted that semiosis required the participation of all three components of the sign; each component serves as a connecting link to the other two. The irreducibility of the sign relation raises questions about the sort of approach to critical thinking that Ennis proposed.

Another way of thinking about semiosis involves its potential as a theory of learning. Although relatively unexplored, semiosis promises a vital, and decidedly non-behavioral, theory of human learning.

Third, the fact that signs generate interpretants which point to something other than what the sign represents suggests that sense-making involves the creation of new ideas. This implies that we can't evaluate knowledge without simultaneously generating knowledge. Models which portray critical thinking as a matter of evaluating statements by following the rules of logic step-by-step are unlikely to be adequate. In the sections that follow, we will see that critical thinking is a dynamic and non-linear process when examined in use.

Finally, what's intriguing about semiosis is that it both conceals and reveals this swirl of interpretants to us. We don't usually think about how we make sense of our world; we take sense-making for granted, at least until we encounter something that doesn't make sense.

In light of the power of semiosis both to conceal and reveal meaning, the last reason semiosis is important to understanding critical thinking becomes apparent: it offers the possibility of reflection. The very same process that is used to ascribe meaning to shapes and sounds can be turned back on itself; we can pull our thoughts from the stream of experience and take them as objects of thought themselves. This process of examining our own thoughts is the act of reflection. We turn first to Dewey and then to Peirce to uncover this essential aspect of critical thinking.

Chapter 4

Critical Thinking in Semiotic Perspective: A Process of Inquiry

Dewey (1933) argued that reflective thought is not identical to the signifying function (semiosis). It involves:

> (1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity. (p. 12)

John Dewey was among the students enrolled in Peirce's logic courses at Johns Hopkins University (Fisch, 1977).

The process Dewey describes fits Peirce's description of knowledge. Peirce defined knowledge as a process of settling doubt and fixing belief. In other words, to know was to inquire. His views are succinctly stated in the following passage:

> To Peirce, knowledge is no longer regarded statically as a body of propositions resembling a more or less finished building, but dynamically as a process of inquiry. (Skagestaad, 1981, p. 18)

Dewey published Logic: The Theory of Inquiry *in 1938, after reviewing the first six volumes of Peirce's collected papers, which were published between 1931-1935. Dewey acknowledged Peirce's influence on his view of logic, noting that Peirce was "the first writer on logic to make inquiry and its methods the primary and ultimate source of logical subject matter." (cited in Fisch, 1986)*

The image he used to capture this formulation was that knowledge is like walking on a bog:

> [W]e never have firm rock beneath our feet; we are walking on a bog, and we can be certain only that the bog is sufficiently firm to carry us *for the time being*. Not only is this all the certainty that we can achieve, it is also all the certainty we can rationally wish for, since it is precisely the tenuousness of the ground that constantly prods us forward....Only doubt and uncertainty can provide a motive for seeking new knowledge. [*emphasis added*] (Skagestaad, 1981, p. 18)

There are several themes embedded in Peirce's account of knowledge that should be noted, for they show how Peirce differs from thinkers like Ennis, who rely on conventional logic for their conception of critical or reflective thought. First of all, Peirce said that knowledge is something dynamic—a process. This is an important point because it does not limit critical thinking to making judgments about static statements but, instead, brings reflective thought into the realm of action and use.

Second, Peirce does not set up "truth" as the goal. Unlike practitioners of conventional logic, Peirce understands that we have to

abandon any hope of knowing that something is true once and for all and be satisfied with the idea that we can only be certain about something for the time being. In fact, he claims that the pragmatic stance toward truth and certainty improves on traditional logic; for it is this uncertainty that sets the process of knowledge-making in motion. In describing what for him was a process of inquiry employed by scientists, Peirce comes closer to a description of how critical thinking is practiced than any that traditional logic can achieve.

Peirce's view of logic

Peirce maintained that the process of settling doubt and fixing belief is accomplished through deliberate and self-controlled thought. As noted earlier, this is a special case of semiosis in which thought itself becomes the object under consideration. This process, which Peirce called *reasoning* (Snyder, 1986), was one part of his conceptualization of logic.

An excellent account of Peirce's approach to logic can be found in The Literacy-Logic Debate: Toward a Clarification from a Peircean Perspective *(Snyder, 1986).*

What's important to understanding Peirce's contribution to critical thinking is that he did not limit logic to a set of rules for verifying, or establishing, the truth of thought. Snyder (1986) explains that Peirce extended the realm of logic to include both the process of establishing a match between "forms of thought and forms of the natural world" (Deely, 1981, p. 208) (*semiosis*) and the use of that process as part of a methodology in settling doubts. This is what scientists try to do: establish a match between their descriptions of the world and the world as an object. To arrive at an adequate description, Peirce found he first had to explain how we make meaning or come to know the world and then to show the ways we use that meaning-making process to both arrive at and solve problems. Both semiosis and inquiry were part of logic.

The Peirce Edition Project, housed at Indiana University-Purdue University at Indianapolis, is publishing C.S. Peirce's writings in chronological order. This series should evolve as a major contribution to understanding the full scope of his work. The first three of a projected 20-volume series are already available.

Peirce's approach to logic grew out of his own experiences as a scientist. He directed two fields of research during his 30 years at the U.S. Coast and Geodetic Survey, which served as the chief scientific agency of the U.S. Government at the time. The first area of research was photometric studies of stars in a region of our galaxy, with the goal of determining more accurately the shape of the galaxy. The other area was pendulum-swinging determinations of absolute and relative gravity so as to more accurately determine the figure of the earth. (Fisch, 1986)

In addition, Peirce was a chemical engineer and a mathematician. But, as Max Fisch (1977) explains: "Peirce's devotion to science itself [was] his way of devoting himself to logic." (p. 32)

It was his experience as a scientist that led to Peirce's contention that all knowledge is mediated by signs. And it was his scientific background that led him to posit a normative as opposed to an absolute view of logic. Peirce argued that science is always undertaken by a community of knowers and not individuals; norms for valid claims are established by this community and do not exist independently of it. In short, his was a social perspective on logic or inquiry.

It is Peirce's position on formal doubt, among others, that has contributed to his lack of prominence among contemporary academic philosophers. Only in recent years has his reputation and work been in the ascendancy.

The role of skepticism in inquiry

We have noted that for Peirce the process of inquiry is set in motion by doubt and uncertainty, but it's important also to note that Peirce was not a skeptic. He argued that we cannot live with doubt on a daily basis and therefore should not doubt that which we take to be stable. In other words, we can't doubt everything we encounter or else we'd never get out of bed in the morning.

The sort of doubt that is productive, then, is that doubt which is felt. Most often the feeling of doubt arises when an anomaly – something which doesn't make sense – is encountered. Both McPeck (1981) and Cornbleth (1985) have implicitly drawn on this concept of doubt in defining critical thinking. For example, McPeck writes, "critical thinking requires the judicious use of skepticism, tempered by experience, such that it is productive of a more satisfactory solution to, or insight into, the problem at hand." (p. 7)

Likewise, Cornbleth says, "The essence of critical thinking is informed skepticism." (p. 13) The skepticism they allude to is not frivolous or indiscriminate; McPeck claims that skepticism is judicious in light of the norms and standards of the subject area in question. Like Peirce, McPeck rejects "paper doubt" – that doubt which is not actually felt – as a basis for further reflection.

A cycle of reasoning

Peirce defined reasoning as a continuous cycle of abduction, deduction, and induction. These three ways to make inferences can be distinguished in the following manner: first, hypotheses are generated through abduction; the possible consequences of those hypotheses are

then developed through deduction; finally, these consequences are tested out against experience so that the hypotheses can either be accepted or modified.

At first glance, this three-fold division of inferences may seem unnecessary. We commonly think of just two kinds of inferencing: deduction and induction. But Peirce argued that induction actually involved two different processes: one he called *abduction*, in which an hypothesis is put forth as a tentative framework; and the other, he called *induction*, in which this framework is tested by selecting particular instances suggested by the framework (Deely, 1981; Fisch, 1986).

In terms of scientific inquiry, anomalies play a much more prominent role in a semiotic perspective than they do in conventional positivistic research. There are no "measures of central tendency" as such in semiotic inquiry.

In abduction, then, the hypothesis that is generated provides a tentative explanation of what is, at first, unexpected and puzzling. On the basis of incomplete information, one offers an explanation that, if true, would show that the surprising observation is a matter of course (H. Smith, 1988). The hypothesis that is adopted serves as a frame of reference within which "trifles," as Sherlock Holmes called the perceptual judgments he continually made, become meaningful.

Anomalies, those perceptual judgments or observations that seem unexpected, play a crucial role in abductive reasoning; they motivate the formation of new connections among prior judgments in such a way as to generate an hypothesis that explains the unexpected. Like Sherlock Holmes, William of Baskerville depends on abduction to explain why he meets the cellarer on the path to the abbey. His hypothesis, that the abbot's favorite horse has escaped and can be found along the path leading to the dungheap, provided a frame of reference for the myriad of perceptual judgments he made as he approached the abbey. In an exchange reminiscent of Sherlock Holmes and Dr. Watson, Brother William says to Adso:

> "I am almost embarrassed to repeat to you what you should know. At the crossroads, on the still fresh snow, a horse's hoofprints stood out very neatly, heading for the path to our left. Neatly spaced, those marks said that the hoof was small and round, and the gallop quite regular – and so I deduced the nature of the horse [Peirce would say he has confused deduction with abduction and should say he abduced the nature of the horse] and the fact that it was not running wildly like a crazed animal...."
>
> "Yes," I said, "but what about the small head, the sharp ears, the big eyes...?"

> "I am not sure that he has those features, but no doubt the monks firmly believe he does.... If the horse whose passing I inferred had not really been the finest of the stables, stableboys would have been chasing him, but instead, the cellarer in person had undertaken the search." (p. 24)

And, if this display were not enough, Adso asks why Brother William called the horse *Brunellus*. To this, William replies:

> "May the Holy Ghost sharpen your mind, son!" my master exclaimed. "What other name could he possibly have? Why, even the great Buridan, who is about to become rector in Paris, when he wants to use a horse in one of his logical examples, always calls it Brunellus."
>
> This was my master's way. He not only knew how to read the great book of nature, but also knew the way the monks read the books of Scripture, and how they thought through them. (p. 25)

Consider, too, that critical thinking is a truly synergistic process. The cyclical nature of reflection is fundamental, and the various subprocesses are not likely ever to be discrete or isolated.

Here we find a virtuoso performance of the kind of reflective and skeptical thought that many scholars regard as fundamental to critical thinking. Clearly, William of Baskerville demonstrates the relationship between domain-specific knowledge (in his case extensive knowledge of the world of nature and the world of monks) and hypothesis formation (in the form of abductive inferencing). When Brother William's reasoning is examined in light of the cycle of abduction, deduction, and induction, it is clear that his pronouncements about the abbot's horse are economical but limited to the status of a "maybe." This is not an insignificant move; indeed, Peirce argued that abduction was the only form of logic capable of starting new ideas. At the same time, the "maybe" must itself become an object of reflection. This is the function of deduction—to draw out possible consequences of the hypothesis. And, finally, this possible world must be compared to the "actual" world (Eco, 1983), something that William did not do himself but left to the monks.

For these and other reasons, abduction has been offered as the key element in early language development in infants (Carey, 1983, 1984).

Critical thinking: An attitude of inquiry

Peirce's ideas lend clarity to the idea that critical thinking is reflective skepticism, and they offer new insights into the nature of critical thinking. His explanation of semiosis provides the basis for understanding that reflection is not a linear process but one in which problems and decisions can be evaluated in terms of both their bases and their potential meaning or consequences. And his conceptualiza-

tion of logic as a process of inquiry, that is, as a process of generating and refining knowledge through abduction, deduction, and induction suggests that critical thinking enables us to formulate the hypotheses as well as investigate them.

Finally, Peirce recognizes that the sort of doubt which motivates inquiry is the doubt that is experienced when an anomaly is encountered. This implies that critical thinking is always a search for meaning and not for enduring truth; anomalies are always contextually defined against the background of the networks of interpretants, or webs of significance (Geertz, 1973), that comprise culture.

Together, these insights show that critical thinking is not a fundamentally different sort of thinking; it is a special case of ordinary thinking. It's important to keep in mind that Peirce was interested in describing the process of inquiry that scientists used to make sense of the world, and therefore, meaning-making figures centrally in his concept of reasoning.

The requirement that reasoning be deliberate and self-conscious does not necessarily mean that critical thinkers show evidence of evaluating the form of their thinking apart from the content. We are left, therefore, with the idea that critical thinking is less a set of sure-fire procedures than an attitude of inquiry.

Chapter 5

The Practice of Critical Thinking

The discussion of critical thinking so far has described what scientists and detectives do. But the practice of critical thinking is also necessarily located in everyday situations, and such "ordinary" thinking can be characterized as "critical." In the world of everyday thinking, critical thinkers are reflective and generative; but their reflections are aimed at problem definition and refinement in the context of purposeful action.

People rarely end up looking like critical thinkers in contrived experiments; they seem to trip over the very logical processes thought essential to the task (Gardner, 1985). And yet, James Herndon (quoted in Gladwin, 1985) maintains there is no "dumb class" in daily life; somehow people are able to act in ways that seem reasonable despite the poor performance exhibited in experiments calling for "pure reasoning," which usually involve abstract tasks stripped of purpose and meaning. A close look at the thinking that grocery shoppers employ while shopping may give some indication as to why shoppers look critical and subjects in experiments look confused.

For purposes of convenience, people are assigned to various performance categories in conventional psychological experiments. These categories have no analogue in daily experience.

Thinking critically in the grocery store

Murtaugh (1985) studied the arithmetic procedures shoppers use by asking 24 shoppers to "think aloud" as they shopped. One of the things he found was that the shoppers generated, as well as solved, their own problems. He writes:

> Supermarket arithmetic does not begin with a well-defined problem that calls for a specific numerical answer. Instead, problems begin when the shopper is in some doubt about what item, or how many, to buy. The shopper then calls upon any information that is available and relevant for making the decision, inducing numerical information. (p. 192)

To show how shoppers think when shopping, Murtaugh provides the following protocol in which a shopper who has stopped to buy apples decides how many to buy:

> I just keep putting them in until I think there's enough. There's only about three or four at home and I have four kids, so you figure at least two apiece in the next three days. These

> are the kinds of things I have to resupply. I only have a certain amount of storage space in the refrigerator, so I can't load it up totally. Now that I'm home in the summertime, this is a good snack food. And I like an apple sometimes at lunchtime when I come home. (p. 188)

Murtaugh reports that if the shopper were doing straight arithmetic calculations, she would have figured two apples *times* four kids *times* three days *minus* four apples at home *plus* one for herself equalling 21 apples. But the shopper only bought nine apples. Something other than algorithmic thinking seems to be going on here.

In what sense can this protocol be said to show evidence of critical thinking? Clearly, this shopper's thinking is not internally consistent and hence not "logical" in the traditional sense of the term. Not only do the conclusions not follow from the premises, the premises themselves are shifting and *ad hoc*. Recall that Ennis insisted that there were no extenuating circumstances in deciding whether a conclusion follows from its premises – that either a conclusion follows or it doesn't.

But from a semiotic perspective, it is clear that this shopper exhibits an attitude of inquiry, or reflective skepticism, that allows her to solve her problem (Peirce would say settle doubt) in accordance with the relevant domain of knowledge (household patterns). The sort of reasoning she uses is not linear. Instead of deducing out conclusions from static premises (which would have led her to purchase more apples than she could store), she "closes the gap" between the problem and its solution by simultaneously generating an hypothesis about how many apples to buy and refining it in terms of the potential consequences. Significantly, the doubt she entertains is not "paper doubt" but doubt that arises out of need. In short, the reasoning this shopper uses is in the service of action; it functions in a context where she defines the purpose and she decides what is meaningful. This, Murtaugh argues, is what distinguishes grocery store math from school math and might give us some idea about why critical thinking might not look critical in everyday situations.

In everyday situations the actor is focused on the problem, the doubt he or she experiences; there seems to be less attention paid to the strategies as strategies. This doesn't mean that reflection does not occur. In the example above, the shopper reaches a decision based on how many apples she currently has at home, how many her family

usually consumes, and how much storage space she has available. She weighs the potential meaning of her decision and not just the form of the decision-making process.

In semiotic terms, her decision-making itself becomes an object of thought; but the focus of decision-making is meaning. If the only thing that counts as critical thinking is evaluating the form of the process, then few people will look like critical thinkers in *any* setting. A semiotic perspective makes it clear that humans live and breathe meaning, and so critical thinking can never be adequately depicted if meaning is not the core of the process.

Thinking critically in kindergarten

We may be able to locate critical thinking in the grocery store, but can it be found in a kindergarten class? The following episode suggests that we rethink the idea that critical thinking is a special type of thinking.

Becky Reimer was working with several kindergarten classes and was interested in collecting some writing samples from students. She offered one child, Heidi, a blank piece of paper and said, "Heidi, can you write your name and anything else you can write?"

Heidi said, "Okay," and produced the piece seen in Figure 2. As she wrote, she said to herself, "Ah – who cares – I'll just copy. I know how a Y goes because I'm copying." Heidi continued to copy words she

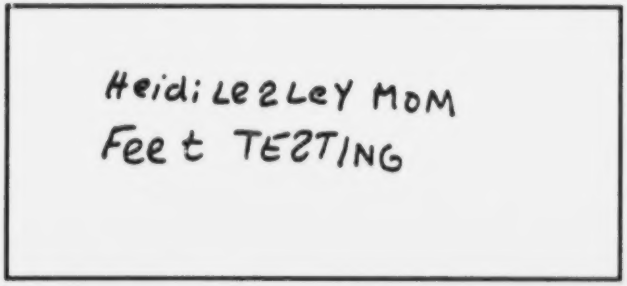
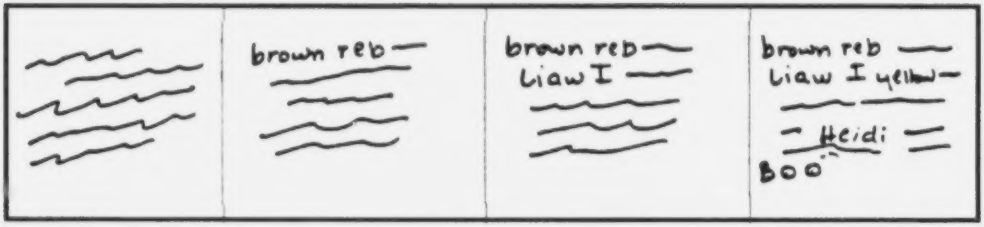


Figure 2: Heidi's uninterrupted writing

saw in the room. Then Becky said, "Okay, Heidi, I'm going to write you a letter now. Maybe you might like to write me a letter on this sheet of paper. Let's see. 'Dear Heidi, I like your red dress. I like your white apron. From, Mrs. Reimer.'"

Heidi took her blank piece of paper and pretended to write her message while saying it aloud. "Dear Mrs. Reimer, I like your pretty green outfit. From, Heidi." She placeheld her message with invented cursive writing. She then began to erase the invented writing at the top of the page and said, "Ah – who cares? Except for I can just keep this here," and she copied *brown* from the wall to represent *dear*. Then she copied *red* to placehold *Mrs.* and left the invented writing for *Reimer*.



a b c d

Figure 3 (a-d): Heidi's letter writing and revision

She continued to erase more of her scribbles and wrote "Jiaiw I" and then "Heidi G." She added "BOO" to the bottom of her paper. (See Figure 3.)

When Heidi read her letter to Becky, she pointed to the word *yellow* when she read *green* and told the researcher she just put "BOO" on her paper for fun.

Heidi's initial response was to write her name conventionally. The pragmatics of the situation (she was in school, interacting with an adult; lists of words were displayed around the room) led her to interpret the request to "write anything else you can write" as a request for a list of conventionally spelled words. And so she copied the words *Lesley, Mom, feet*, and *testing* onto her paper.

Then Becky shifted to a more purposeful task – letter writing – and composed aloud while Heidi watched. When it was her turn to

write a letter, Heidi used invented cursive script to placehold her message (Harste, Woodward, and Burke, 1984). Although her invented script was a less conventional response than the list of words initially produced, it indicated Heidi's understanding of the signifying function: written marks can stand for something else.

More intriguing, however, is the revision process that Heidi initiated after reading her letter to Becky. It is as if the juxtapositioning of Becky's conventionally scripted letter and Heidi's invented script raised some doubts in Heidi's mind about the way written communication works in purposeful contexts. She paused and then began to erase her invented writing and to replace it with color words copied from a list displayed on her table.

Heidi is clearly responding to the functional aspects of communicative context. She is doing what she perceives as necessary to create meaning.

This was not a random decision. It represented, instead, her latest hypothesis about written communication—namely, that words, not invented script, make communication possible and that the choice of words is not arbitrary but connected to the semantic field of the message. The theme of both Becky's and Heidi's letters was colors. Hence, it is not a surprise to find that Heidi adopted a strategy wherein color words were used to communicate her message.

This may well be the only case in which copying words is an instance of critical thinking! What's interesting about this literacy event is that Heidi *took the signifying function as an object of thought*; this reflective action led her to reconsider her initial decision and allowed her to use abduction to generate a new *hypothesis* about the written language system. This hypothesis allowed her to make sense of what might have been puzzling to her—Becky's use of color words, not random words or invented writing. It seems clear that Heidi exhibited an attitude of inquiry or reflective skepticism with regard to the task of writing a letter or of writing what she knew and must therefore be credited with critical thinking.

Finally, this example suggests that critical thinking is, at base, a learning strategy. It provides a way to move beyond current boundaries to new arenas of thought. In Peirce's terms, Heidi has demonstrated Peirce's belief that knowledge is like walking on a bog; she explored new hypotheses in order not to become mired in her present world-view.

Chapter 6

Classroom Contexts for Critical Thinking

Gladwin (1985) suggests that the reason there's no "dumb math class" in everyday life is that math is not marked off as a separate "subject" but woven into the fabric of action; witness the fact that Murtaugh's shoppers did not think they were doing math at all. As noted earlier, proponents of a basic skills approach to critical thinking rely on traditional notions of logic as a set of general rules for evaluating reasoning and therefore want to develop curricula that separate form from purpose and meaning.

Perhaps Gladwin's observation should serve as a warning that if critical thinking is marked off in schools as a separate subject, we run the risk of teaching students to regard critical thinking as something that has no use in everyday life. If, on the other hand, critical thinking *in* school is as purposeful and meaningful as critical thinking *out* of school, then the transfer effects we hope for might be within reach.

One unfortunate consequence of this view has been the introduction of separate periods of time for instruction in critical thinking skills.

Abductive environments

Other monographs in this series will offer valuable advice about organizing classroom contexts that support the sort of critical thinking we have described. On the whole, those monographs will emphasize classroom contexts that are meaningful and purposeful – that encourage risk-taking and reflective skepticism. To this we would add that classrooms which function as "abductive environments" offer learners opportunities to engage in critical thinking. Too often, only teachers are using abduction, the logic of discovery, in classroom settings; they frame the problem that an anomaly brings to light and involve students only in the use of deduction and induction to solve the problem (Short, 1985).

In abductive environments, students are encouraged to use anomalies as starting points for learning. The advantage to the learners is that they experience hypothesis generation, that crucial but oftimes missing dimension of critical thinking. In emphasizing the generative nature, we are rejecting the notion that critical thinking means

only looking back at the basis for some decision; a nonlinear view of critical thinking suggests that reflection is a search for meaning and that that search is as much an exploration of where an idea might go as it is a look at where the idea came from. Thomas Newkirk's (*in press*) notion of reclaiming the essay as a form (and forum) for *exploration* is one illustration of instruction that invites the sort of critical thinking we have described.

Consider the implications of this view with regard to a definition of teaching. In semiotic terms, teaching might be defined as providing a supportive environment in which abduction may occur, as opposed to a conventional definition which emphasizes the more manipulative or interventionist role.

Supporting critical thinking in classrooms

In closing, we offer a vignette from a first-grade classroom (Reimer and Hunsaker, 1987) to show how abductive environments support the process of critical thinking. In Linda Hunsaker's classroom, reading is organized as a workshop in which the children select their own reading materials. Students can often be found reading in pairs or small groups as well as by themselves. The workshop concludes with a sharing session during which children talk about what they've read with the rest of the class. Often, reading experiences serve as a jumping off point for writing experiences and other projects.

Monday's reading workshop usually includes reading the *Scholastic News*. One Monday in November, the children found partners and read through the magazine. After 15 minutes, Linda called them back to their desks.

"Rachel shared something interesting with me during our partner reading time," Linda said. "Rachel told me after she had finished reading the article about puffins that the article didn't say much. What do you think?"

The children began to turn back to the front page of their magazines and to reread the article. Linda asked, "Well, what did we learn from the article?" The students offered the following statements:

Puffins swim.
Puffins fly.
Puffins live where it is cold.
Puffins eat fish.
Puffins live on the land in June and July.
Puffin babies are born in June and July.

The class agreed with Rachel that they'd learned very little about puffins and began to formulate questions not answered by the article. Forty-five questions were generated. They asked:

"Do they kill men?""
"Do men kill them?"
"How do they protect themselves from danger?"
"Are they like penguins?"
"Where do they live?"

As the discussion continued, Erik looked carefully at the article and noticed that the smallest print on the page was addressed to the teacher and contained the information about where puffins live. He raised his hand and asked why it was addressed only to the teacher.

The students began to brainstorm all the possible reasons the author might have written the piece the way he or she did. They hypothesized:

"There was not enough room."
"They didn't know enough to write more."
"Maybe they didn't think about it."
"They had other things to do – no time."
"Maybe they didn't want us to learn that much about them."
"They wanted us to find out on our own."
"They wanted the teacher to tell us more."
"Maybe they thought we already knew a lot about puffins."
"Maybe they thought we couldn't read more words."

As a result of this discussion, the students wrote letters to the editors of the magazine. They explained their concerns, recommended changes, and asked how editors make decisions. This process of using anomalies to raise questions, frame problems, and motivate inquiry became the basis of curriculum in this classroom for the remainder of the year. Learning took the form of a "theme cycle" (Altwerger and Resta, *in press*). Students explored various subject matter by considering what they already knew, what they wanted to learn, and how they could go about learning it. The reading workshop thus became a reading-writing-learning workshop in which teacher and students joined together to engage in inquiry.

The incident which initiated theme cycles in this classroom illustrates the characteristics of an abductive environment. Rachel approached the magazine with the understanding that reading is a meaning-making process – a learning process; hence, she expected the article to teach her about puffins. When the piece failed to do so, she paused and reflected on this situation. Her comment, "The article didn't say much," marked her surprise. Rather than accept the article

on its own terms, she identified it as problematic. Her skepticism about what she had learned set the stage for further reflection and inquiry.

Notice how the teacher supported the use of critical thinking by her students. She did not "fill in the gap" and tell them more about puffins. She did not suggest that the class investigate the topic of puffins. What she did instead was to share Rachel's comment with the class and ask what *they* thought. In doing so, the teacher showed the children that *their* questions were the important ones in the classroom and that a skeptical attitude—a "questioning the text" attitude was valuable. Her message involved the notion that good questions are better than right answers.

The kinds of questions raised by the children also serve to heighten the problems with traditional categories of "literal," "inferential," and "critical." Although these are convenient terms, there is no special theoretical reason for these levels of questioning to function as discrete operations. This has not, however, prevented their reification on tests and in basal series.

The teacher demonstrated how this attitude led to learning by encouraging the students to return to the text and see whether they felt there was a lack of information. After retelling the article in their own words and deciding that important information was indeed missing, she invited them to generate any questions they might have about puffins. They had many.

Interestingly, their rereading led to the identification of an anomaly: some of the information they were hoping to find in the article was addressed to the teacher in small print. Why would the authors do that? The children's hypotheses about this editorial decision provided tentative explanations for what was, to them, a surprise.

Many first graders would not be surprised to find such vacuous articles in their copies of *Scholastic News*. But traditional definitions of readability (short sentences, "easy" words) had not been a constraint in this classroom. Students read a wide range of materials and used whatever words they needed in their writing. The limited language and concepts found in the puffin article broke the pattern of sense-making that permeated their instructional world.

In their letters, the children not only requested more information about puffins, but they also challenged the editors' norms for first-grade reading. "Dear Editors," one child wrote, "I like your article about Puffins. But could you please tell more about Puffins?!? Why did you tell only the teachers that they live at the Arctic?? Please write more."

Finally, this example of critical thinking in first grade shows how the social organization of the classroom can contribute to the inquiry process. It was because Rachel read with a partner (in this case, her

teacher) that her comment became public and hence the impetus for reflection. Furthermore, the multiple perspectives available in a class of 25 first graders added to the fruitfulness of reflection. In fact, the inquiry process was opened up further by Erik's comment about the small print for teachers. So, while Rachel may have initiated the process, she was not the sole owner. It was the class that retained ownership of the inquiry.

In summary, the social organization of the classroom context allows children to engage in critical thinking, see it demonstrated by their peers as well as their teacher, and come to value this process (Harste, Woodward, and Burke, 1984).

In the end, it may be more productive to assume that children enter school as critical thinkers. If critical thinking is not a special sort of thinking but a special case of ordinary thinking and if we can locate the practice of critical thinking in grocery stores and primary-grade classrooms, then we may need to reconceptualize not only critical thinking but our job as educators. Like other authors in this series, we believe that our job will be less a matter of providing instruction in the "skills" of critical thought than of offering support for and experience with the attitude of inquiry (*cf.*, Kuhn, 1986).

Education for thinking is the challenge of the 1990s, and it is literacy educators who must take the lead in shaping the classroom contexts that support critical thinking. We have been down the road of isolated skills instruction before (*cf.*, F. Smith, 1986). It may be that in offering new ways of thinking about critical thinking, semiotics offers a new road.

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Perspectives on Critical Thinking

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The impact of Ennis' critical thinking skills

Beyer, Barry K. "Critical thinking: What is it?" *Social Education*, 49 (4), April 1985, pp. 270-276. [EJ 316 045]

Developing an accurate, commonly accepted definition of critical thinking is absolutely essential. Critical thinking is defined as the process of determining the authenticity, accuracy, and worth of information or knowledge claims. It consists of a number of discrete skills.

Beyer, Barry K. "Improving thinking skills – defining the problem," *Phi Delta Kappan*, 65 (7), March 1984, pp. 486-490. [EJ 294 947]

Identifies five obstacles to effective teaching of thinking skills, including lack of consensus among teachers, lack of knowledge among teachers, mistaking of skills testing for skills teaching, teaching of too many skills in too little time, and testing that inhibits students' thinking skills.

Beyer, Barry K. "Teaching critical thinking: A direct approach," *Social Education*, 49 (4), April 1985, pp. 279-303. [EJ 316 050]

A framework for teaching critical thinking skills is presented, and specific strategies that can be used at key places in this framework are outlined. The framework requires that teachers employ direct, systematic instruction.

Beyer, Barry K. "What's in a skill? Defining the thinking skills we teach," *Social Science Record*, 21 (2), Fall 1984, pp. 19-23. [EJ 307 583]

To improve the teaching of thinking skills, social studies teachers need to identify and select a few key skills on which to focus continuously throughout the K-12 social studies curricula. They also need to identify the attributes of these skills. A model skill description is included.

Blai, Boris Jr. "Thinking skills and intelligence." (1986). 12 pp. [ED 286 830]

This review of research and of the views of researchers prominent in the field of thinking skill development discusses the role of thinking skills in the ability to formulate problems, resolve issues, determine the most effective decisions, and create effective solutions to problems. The views of Edward deBono, Robert Ennis, Reuven Feuerstein, Matthew Lipman, David Perkins, Robert Sterling, and Arthur Wimberg are synopsized, as is research regarding essential, higher-order, metacognitive, and epistemic cognitive processes.

Bruneau, William. "The pleasures and perils of inference: Informal logic and the teaching and doing of history," *History and Social Science Teacher*, 21 (3), Spring 1986, pp. 165-75. [EJ 346 278]

Shows through examples how formal logic may be used to support historical reasoning. Identifies five stages of thought required to construct sound historical arguments. Includes a list of 16 logical fallacies.

Delattre, Edwin J. "Ethics and critical thinking throughout the curriculum." Paper presented at the Annual Meeting of the National Association of Independent Schools, 1981. 15 pp. [ED 206 519]

Educators can incorporate ethics and critical thinking into the curriculum in a variety of ways, including focusing attention on the purposes and method of argument (i.e., stressing argument as a method of discourse in which claims are supported by evidence); showing students how to do deductive demonstration and confirmation and falsification of hypotheses; introducing them to logic; involving them in writing assignments stressing reason; cautioning them against simplistic dogmatism (the assertion that nothing needs to be thought about because everything is already known); pointing out the pitfalls of absolute relativism (the belief that nothing is genuinely right or wrong); and exposing them to lessons in which ethics and critical thinking as well as their opposites are in practice.

Ennis, Robert H. "A concept of critical thinking," *Harvard Educational Review*, 32 (1), Winter 1962, pp. 32. [ED 021 832]

Presents a dimensional simplification of the concept of "critical thinking" ("the correct assessing of statements") which will provide a basis for research. Three dimensions of critical thinking—logical, criterial, pragmatic—are distinguished; and 12 aspects of critical thinking are identified and elaborated by a discussion of the "dimensional makeup" of each and by lists of criteria to be used in making judgments.

Ennis, Robert H. "Children's ability to handle Piaget's propositional logic: A conceptual critique," *Review of Educational Research*, 45 (1), 1975, pp. 1-41. [EJ 120 197]

Presents Ennis' views about Piaget's theories of child development.

Ennis, Robert H. "Conditional logic and primary children." Paper presented at the Annual Meeting of the American Educational Research Association, 1970. 13 pp. [ED 038 186]

Conditional logic, as interpreted in this paper, means deductive logic characterized by "if-then" statements. This study sought to investigate the knowledge of conditional logic possessed by primary children and to test their readiness to learn such concepts.

Ennis, Robert H. "Logic in thinking and teaching," *High School Journal*, 55 (6), 1972, pp. 278-296. [EJ 056 368]

Suggests things teachers can do and guidelines they can use in order to raise the logical quality of classroom interaction and student abilities.

Ennis, Robert H., *et al. Conditional Logic and Children*, Cornell Critical Thinking Readiness Project, Albany: New York State Education Department, 1969. 208 pp. [ED 040 437]

Although experimental audio-tutorial methods were not effective in teaching conditional logic to young children, many subjects learned it anyway.

Greenwell, James. "What good is philosophy?" *Contemporary-Education*, 49 (2), 1978, pp. 113-114. [EJ 182 410]

Contends that a study of logic enables students to see what constitutes valid arguments and legitimate fallacies and enables them to apply this to situations in their lives so they can make sound decisions.

Hay, Ellen A. "The critical thinking movement and its implication for the teaching of speech communication." Paper presented at the 73rd Annual Meeting of the Speech Communication Association, 1987. 12 pp. [ED 190 196]

Reviews the literature on teaching critical thinking skills and discusses its relevance for speech communication instruction. Definitions of critical thinking are discussed—differing depending on point of view. Types of thinking skills programs are listed, including the following: 1) general thinking skills programs that can function within a communication curriculum, 2) programs that concentrate on particular skills (such as argumentation, persuasion, debate, and logic) in particular content areas, 3) programs that teach thinking skills in isolation, and 4) programs designed specifically for speech communication classes. Several theoretical bases for assessment are presented, and the merits of different standardized measures are also debated. The implications of the critical thinking movement for speech communication instruction, including the importance of cognitive and metacognitive aspects of instruction and the transfer of thinking skills to other contexts are discussed.

Klein, Marv. "A stab at teaching comprehension of the conditional," *Journal of Reading, 19* (2), pp. 154-159. [EJ 125 708]

Concludes that if students learn "if-then" propositions, then their reasoning abilities will improve.

Paul, Richard W. "Critical thinking and the critical person," 1986. 44 pp. [ED 273 511]

The work of four leading critical theorists (Robert Ennis, Harvey Siegel, Michael Scriven, and R. S. Peters) is described and a distinction is made between the holistic approach of most critical thinking philosophers and the general approach of most cognitive psychologists. A premise of the paper is that global insights into the obstacles to critical reflection, critical inquiry, and critical discussion on the part of students, teachers, and the general public are crucial to sound design of critical thinking instruction. Teachers, however, rarely grasp where and when the concept of free critical discussion is essential, what it means to conduct it, and what is required to empower students to pursue it with understanding and self-command.

Pearson, Allen T. "Can teaching be more logical?" *Elements: Translating Theory into Practice, 7* (2), 1985. pp. 5-6. [EJ 133 962]

Attempts to outline a concept of logic that involves standards of correct reasoning as well as some idea of how these might be carried out in a classroom.

Stewart, Bruce L. "Teaching logic in grades 7-12: A literature review." Urbana, Illinois: Bureau of Educational Research, 1978. 41 pp. [ED 183 587]

Literature on teaching deductive logic in grades 7 through 12 is reviewed. Fourteen studies are critiqued in tabular form.

Peirce's and Dewey's influence

Armstrong, Carmen L. "Stages of inquiry in art: Model, rationale and implications," 1982. 35 pp. [ED 223 608]

The structure of inquiry in art is presented as a set of 9 behavioral stages comparable with creative process stages, in which persons think in and about the visual mode of perception. The stages include behaviors identified by Dewey as factors or phases of reflective thought and as stages in the pattern of inquiry. The stages also show relatedness to problem solving, critical thinking behaviors, and other delineations of inquiry that can be extended into practice by art teachers.

Baron, Jonathon. "Reflective thinking as a goal of education," *Intelligence, 5* (4), October-December 1981, pp. 291-309. [EJ 260 805]

Dewey's notion of "reflective thinking" is discussed. A model of phases of reflective thinking is described: problem recognition, enumeration of possibilities, reasoning, revision, and evaluation. Each phase has at least one parameter governing its operation and one rule for setting the optimum parameter value. Sources of individual variability are discussed.

Berry, Elizabeth. "The unit process." Reprint from *Educational Forum*, March 1963, pp. 357-366. [ED 049 200]

Dewey and his followers sought a way to provide the young with conditions essential to thinking. For all practical purposes, they considered reflective thinking and problem solving one and the same. Consequently, a method of teaching was devised which was based on problem solving: the unit method. In practice, this method permits students to formulate and answer significant questions in their subject fields. Opposition to this method is usually based on an incomplete comprehension of what the unit method of teaching involves.

Cooper, Ted. "The concepts of knowledge of Peirce and Dewey – the relation to education," 1967. 39 pp. [ED 010 852]

Summarizes the principal epistemological concepts of pragmatism and of its offspring, Dewey's experimentalism. Appraises briefly the major differences between Peirce's seminal theory and Dewey's adaptations that influenced later developments in educational theory. Finally, posits a concordance between pragmatic epistemology and cognitive consistency theories as illustrative of one of several dimensions for continuing study.

Emerson, Goldwin J., and Ayim, Maryann. "Dewey and Peirce on curriculum and the three R's," *Journal of Educational Thought, 14* (1), April 1980, pp. 23-37. [EJ 229 265]

The first of these two companion papers presents an account of Dewey's position on the nature of growth and its implications for curriculum development. The second paper provides a critique of Dewey's concept of growth and sketches what C. S. Peirce would have regarded as more viable alternatives.

Gardner, Martin. "Mathematical games," *Scientific American*, 239 (1), 1978, pp. 18-26. [EJ 185 868]

Describes the life and work of Charles Peirce, U.S. mathematician and philosopher. His accomplishments include contributions to logic, the foundations of mathematics and scientific method, and decision theory and probability theory.

Kitchener, Karen Strohm. "Educational goals and reflective thinking," *Educational Forum, 48* (1), Fall 1983, pp. 75-95. [EJ 287 743]

Examines the nature of reflective thinking and its necessity as an educational goal. The work of John Dewey, empirical approaches to reflective judgment, evidence of students' ability to use it, and implications for education are discussed.

Lyne, John R. "Rhetoric and semiotic in C. S. Peirce," *Quarterly Journal of Speech, 66* (2), April 1980, pp. 155-68. [EJ 225 120]

Outlines Peirce's philosophy of rhetoric by examining his philosophy of signs and sketching his specific program for rhetoric as a general way of "rendering signs effective." Suggests that Peirce's work is part of a fully elaborated system of inquiry and signification.

Maiorana, Victor P. "The critical thinking dimension of John Dewey and its impact on teaching." In Green, Judith (Ed.), *et al. Educational Dimensions,* Issue 5, New York State Association of Two-Year Colleges, 1985. 47 pp. [ED 264 923]

Chapter 4 in a printed forum of issues pertinent to education at the two-year college level.

McCarthy, Joseph M. "Was Peirce an 'educational' philosopher?" Paper presented at Annual Meeting of the New England Educational Research Organization, 1971. 16 pp. [ED 054 726]

Charles Sanders Peirce, the progenitor of an entire school of philosophy, profoundly influenced our educational system, yet was curiously silent on educational questions. This paper discusses his early upbringing and schooling, and his involvement in education as a lecturer and professor. The major focus is on Peirce's written thoughts on education, which were sparse. The longest of these was in the form of a letter to Daniel Coit Gilman, written January 13, 1878. It expresses Peirce's thoughts on the organization and administration of an academic department, as well as his conviction that in the teaching of science "the professor's object ought to be to let his pupil as much into the interior of scientific thinking as possible, and for that purpose he should make his lecture experiments resemble real ones as much as possible." He felt that students who intended to be physicists should be in a laboratory situation from about age 9 to 12 and then return at 18 or 20. Peirce also wrote on mathematical logic and its relation to education, and on the nature of the university. He also gave consideration to teaching mathematics. His thoughts on education were systematic and evolved in the light of his "pragmatic" principles.

Orr, Leonard. "Intertextuality and the cultural text in recent semiotics," *College English, 48* (8), December 1986, pp. 811-823. [EJ 343 601]

Criticizes R. Scholes' application of French semiotics; clarifies C. Peirce's and F. Saussure's concepts of semiotics as applied to cultural semiotics; examines the Internal Field of Reference, and asserts an interpretive relationship between cultural text and episteme. Discusses intertextuality and concludes great implications for literary study by privileging the literary text as a microtext within a specific cultural macrotext.

Rosen, Joan G. "Problem solving and reflective thinking: John Dewey, Linda Flower, Richard Young," *Journal of Teaching Writing, 6* (1), Spring 1987, pp. 69-78. [EJ 357 955]

Discusses the affinities between L. Flower's problem-solving method, R. Young's tagmemic invention, and Dewey's reflective thinking, each strategy equally focusing on choices to be made allowing the thinker/writer to make order out of incongruity and dissonance. Applies Dewey's five phases of reflective thought to writing.

Ross, Wayne E. "The evolution of the relationship between reflective inquiry and social studies education: Implications for the future." Paper

presented at the Annual Meeting of the National Council for Social Studies, 1985. 32 pp. [ED 276 677]

Following a brief discussion of the lack of definition and cohesion in the social studies and the curriculum, the paper argues that the reflective inquiry rationale has had the most significant influence of all the alternative rationales for the field and its curriculum. "Historical Development of the Reflective Inquiry Model" traces the development and refinement of reflective inquiry from the concepts of John Dewey through restatements by a long line of educators. "Current Conceptions of Reflective Inquiry" examines two perspectives on reflective inquiry; these have been described as the logical-analytical and reflective skepticism models. "Criticisms of the Logical-Analytical Model of Reflective Inquiry" criticizes the assumptions, nature, and application of the model most dominating current inquiry presentations. "Implications for the Future: Fostering an Alternative Approach to Reflective Inquiry" explores the opportunities, roadblocks, and prospects for reflective inquiry in social studies classrooms. An extensive reference section is included.

Van Sickle, Ronald L. "Research implications of a theoretical analysis of John Dewey's 'How We Think,'" *Theory and Research in Social Education*, 13 (3), Fall 1985, pp. 1-20. [EJ 324 548]

John Dewey's theory of reflective thought as presented in "How We Think" (1933) is analyzed, and components and relationships in the processes of reflective thought and teaching people to think effectively are identified. Implications of the research are discussed.

Perspectives on thinking related to semiotics

Brandt, Ronald S. "On creativity and thinking skills: A conversation with David Perkins," *Educational Leadership*, 43 (8), May 1986, pp. 12-18. [EJ 337 463]

This interview with David Perkins, codirector of Harvard's Project Zero and author of "The Mind's Best Work," focuses on the links between creative and critical thinking styles. Exercises in Venezuela's Project Intelligence are also discussed, along with possible curricular approaches to teaching skills.

Buescher, Thomas M. "Seeking the roots of talent: An interview with Howard Gardner," *Journal for the Education of the Gifted*, 8 (3), Spring 1985, pp. 179-186. [EJ 319 912]

This interview with H. Gardner, a research scientist in neuropsychology, examines his work on the emergence of symbols in children and the implications of early talent development for gifted and creative children. He discusses his research on the multiple talents comprising his conception of intelligence.

Coe, Richard M. "Closed system composition," *ETC: A Review of General Semantics*, 32 (4), 1975, pp. 403-412. [EJ 129 288]

Argues that freshman English courses reinforce Cartesian logic, i.e., logic characterized by thinking in terms of closed systems, and prevent students from grasping more complex phenomena.

Cornbleth, Catherine. "Assessing skills and thinking in social studies." Paper commissioned by the National Assessment of Student Achievement, 1986. 22 pp. [ED 279 671]

The paper addresses: 1) the meaning of cognitive skills and their role in thinking, 2) generic versus specific skills, and 3) implications for the National Assessment of Educational Progress (NAEP). Critical thinking is a skill frequently associated with social studies learning. However, attempts to detail a task analysis of critical thinking skills have met with problems: It is difficult to define a constant concept of thinking; thinking is rarely a process of linear steps; thinking about one question tends to raise others; and thinking cannot be divided into pieces and reconstructed. Skills and thinking are not synonymous and should not be treated as such for assessment. Despite the assumption that thinking skills are generic and transferable from one subject to another, there is evidence that the development of thinking skills is highly knowledge dependent; the separation of subject matter content and thinking process is arbitrary and misleading. Social studies test items should assess either the application of a skill, or the selection and application of the appropriate skill. To assess critical thinking, assessment of thinking and not assessment of separate skills is needed. Test items should include social studies subject matter.

Cornbleth, Catherine. "Critical thinking and cognitive processes." In William B. Stanley *et al.* (Eds.), *Review of Research in Social Studies Education, 1976-1983.* Bulletin 75. Boulder: ERIC/Clearinghouse for Social Studies/Social Science, 1985, pp. 11-64. [ED 255 469; 435 pp. total]

A review of critical thinking and cognitive process research. Special attention is given to "myths" that guide current research and practice.

Cornbleth, Catherine, "Reconsidering social studies curriculum," *Theory and Research in Social Education, 13* (2), Summer 1985, pp. 31-45. [EJ 321 634]

Two views of social studies curriculum development are discussed. The technical project view assumes a linear sequence of discrete events; the social process view assumes a dynamic, interactive relationship among policy, planning, enactment, and their sociocultural context. An alternative conception that integrates technical, social, and critical dimensions is suggested.

Dilworth, Collett B. "Critical thinking and the experience of literature." Paper presented at the 75th Annual Meeting of the National Council of Teachers of English, 1985. 13 pp. [ED 266 477]

Despite the current emphasis on thinking skills and the resulting concentration on lists and taxonomies that do not succeed beyond research contexts, all reflective people know that critical thought relies not on applying mental steps but on simply trying to figure out what might be right or wrong. This depends on one basic cognitive act, contrasting – directing one's initial thoughts to the crucial differences between things or to the distinctions that reveal essential characteristics. This thinking is necessary and natural in the study of literature because writers often use comparison and contrast in their writing, while readers must compare and contrast their understanding against the criterion of the text's assumed coherence. To help students enjoy literature's resonances (the relationships of such elements as images, characters, and circumstances), teachers must foster their critical perceptions and contrastive powers through recognizing and applying contrastive thought. Such critical thought can be taught by example, guided discussion, and independent writing, particularly through use of a divided reader's journal in which students paraphrase and quote contrastive parts of literature texts.

Eco, Umberto. *The Role of the Reader: Explorations in the Semiotics of Texts*, Bloomington, Indiana: Indiana University Press, 1979. [ED 172 170; not available from EDRS.]

The essays in this book focus on the role of the reader in textual interpretation. Specifically, they examine "open" and "closed" texts. The three essays in Part I deal with both verbal and nonverbal texts, including musical compositions and the phenomenon of the "unfinished work" in contemporary art and aesthetic theory. The second and third essays examine how the procedures of aesthetic manipulation of language produce the interpretive cooperation of the addressee. Closed texts are represented by examples from popular culture in the three essays in Part II. These examine the sociopolitical assumptions implicit in Superman comic books, the relationship between rhetoric and ideology in the fiction of Eugene Sue, and the narrative structure in Ian Fleming's James Bond novels. The two essays in Part III provide a theoretical framework for understanding the semiotic stratiegies of open and closed texts, including the contributions of contemporary semantics to the study of narrative and the connection of the modalities of textual interpretation with the problem of possible worlds.

Giordano, Gerard. "Intuitive, logical, and disciplinary organization in critical reading," *Reading World, 16* (1), 1976, pp. 5-8. [EJ 144 632]

Argues that it is not necessary for persons to master formal logic to read critically.

Goodman, Kenneth S., *et al. Language and Thinking in School: A Whole-Language Curriculum*, (3rd ed). New York: Owen, 1987. [ED 278 987; not available from EDRS.]

Exploring many possible relationships among language, thought processes, and education, this book is designed to synthesize modern views of language and linguistics, literature and semiotics, and thinking and knowing that are pertinent to education. It develops theoretical positions about language and thinking in school, proposes practical instructional applications for both beginning and experienced teachers, and provides practical means for building and assessing curricula and instruction. Throughout the book, a view of a dual curriculum based on language and thinking is explicated which reflects new theoretical understandings of how and why both written and oral language develop. Respectively, chapters discuss 1) language, thinking, and learning: focal points of a dual curriculum; 2) language: why and how; 3) language development; 4) language development in social and historical contexts; 5) coming to know; 6) development of thought with language; 7) structuring in thought: meaning; 8) language structuring: grammar; 9) composing letters to the world; 10) reading and writing: a psycholinguistic view; 11) literacy before school; 12) learning and teaching reading: strategies for comprehension; 13) learning and teaching writing: strategies for presentation; 14) children, literature, and the arts, including a special bibliography of children's books; 15) language and thinking: strategies in teaching; 16) teaching tactics and strategies; and 17) building whole-language programs.

Harste, Jerome C., *et al.* "Examining our assumptions: A transactional view of literacy and learning," *Research in the Teaching of English, 18* (1), February 1984, pp. 84-108. [EJ 294 749]

Challenges existing assumptions about literacy and literacy learning in an effort to both demonstrate and explore the transactive potentials of theory and methodology in the study of literacy.

Harste, Jerome C., *et al. Language Stories & Literacy Lessons.* Portsmouth, New Hampshire: Heinemann, 1984. [ED 257 113; not available from EDRS.]

As a result of a program of research about cognitive processes involved in learning to read and write among 3-, 4-, 5-, and 6-year-old children, this book attempts to get teacher-researchers to think through the implications of recent insights into literacy and literacy learning. The first section examines instructional assumptions; proposes a new view of language development; presents a language lesson from a 3-year-old; suggests a new perspective concerning the relationship between literacy and race, sex, and socioeconomic status; and examines literacy assumptions. The second section presents key patterns in language and language learning that were seen in the language stories of the children, and examines the organization of the writing, the intentionality of the children as language users, the generativeness of language, risk-taking as being central to cognitive processing, writing as a form of social action, the text as the basic unit of language, how language is learned, and new patterns in literacy. The third section deals with the conceptual implications and the methodological implications of literacy and literacy learning.

Harste, Jerome C. "What it means to be strategic: Good readers as informants." Paper presented at the 36th Annual Meeting of the National Reading Conference, 1986. 17 pp. [ED 278 980]

A study of graduate students identified strategies used by successful readers in comprehending and interpreting various texts. Seventy-three graduate students were asked to keep a journal (unedited and freely written) of what they were thinking as they were reading Umberto Eco's novel The Name of the Rose. *Results suggest that mentally, good readers spend about 69 percent of their time off the page attempting to make connections, recasting what they have read in terms of what they currently know, criticizing themselves and the author's performance, and/or extrapolating what they have read to see what it might have to say about everything from ethnography to the meaning of life. Findings support the contextual embeddedness of all reading and interpretation and how instructional tasks can bolster the use of reading as a tool for learning. (Data tables are appended.)*

Mackin, Jim. "Meaning and knowledge in a pragmatic theory of rhetoric." Paper presented at the 73rd Annual Meeting of the Speech Communication Association, 1987. 16 pp. [ED 285 233]

The beginnings of a pragmatic rhetorical theory can help relate rhetoric to human meaning systems. A pragmatic rhetorical theory is not concerned with whether or not an intentional experience is true to an objective reality beyond human experience, but rather deals with how rhetoric interacts with experiences in the construction of human meaning theories. A semiotic theory of meaning allows meaning to shift constantly as new signs and new contexts are experienced by the brain, which allows humans to construct "cultural units of meaning" that change as they react rhetorically with others. However, there is no "cultural linguistic competence" to go along with cultural units of meaning, only individual competence, because cultures and societies do not talk, only individuals do. For example, there is no "correct" American language with correct meanings and pronunciations, only individual expressions and content systems. Humans learn to interact as individuals through semiotically experiencing the rhetoric of others, associating denotations with semantic markers used by others, connotations with memories of experiences, and values and attitudes with complex links of connotative and denotative semantic markers. They also try to arrange their dictionaries of signs hierarchically to shape reality (editing entries to create consistent belief systems but never totally eliminating inconsistences from the underlying

rhetorical encyclopedia). In this framework, truth and objectivity are only relative to an individual dictionary, and thus cannot be universal or absolute.

Marble, Meredith. "A critical thinking heuristic for the argumentative composition," *Rhetoric Society Quarterly, 16* (1-2), Winter-Spring 1986, pp. 67-78. [EJ 332 861]

Defines critical thinking by means of its difference from formal logic and its compatibility with current theories of rhetoric. Offers a heuristic for the argumentative composition based on integrating critical thinking with insights from new rhetorical composing theories.

Murnion, William E. "Formality and informality in reasoning." Paper presented at a meeting of the Conference on Critical Thinking, 1987. 18 pp. [ED 287 179]

Advocates and teachers of critical thinking tend to deny that intuition and justification are logical, even though they assume that both processes are rational. However, it can be demonstrated that the relation between intuition and inference, between justification and explanation, is dialectical and complementary, so there is no mystery as to 1) how informal reasoning supplies the content of the knowledge articulated in formal reasoning or 2) how formal reasoning explicates the form of the knowledge acquired in informal reasoning. Although inference and insight are contraries in the strong sense, in a weaker sense inference can include the kind of informal inference implicit in a rational assertion, which makes intuition and inference not only compatible but complementary. In addition, formal inference can be used to make the structure of informal inference explicit, thereby creating further compatibility between informal inference and formal reasoning. Still, discovering a solution to a problem also requires the alternation between justification and explanation of theory; thus inference must be interpreted informally as a dialectic between justification and explanation in the process of achieving equilibrium in the assessment of an argument.

Rud, Anthony G. Jr. "Critical thinking and pre-college philosophy." Paper presented at 67th Annual Meeting of the American Educational Research Association, 1986. 20 pp. [ED 272 415]

Examines a debate recently at the fore of the philosophical and educational literature on "critical thinking," namely, the claim that critical thinking consists of a set of discrete skills which can be taught separately versus the claim that critical thinking is "field dependent" and is thus part of learning a discipline. The works of Robert Ennis, John McPeck, Harvey Siegel, and Matthew Lipman are considered to support the conclusion that though critical thinking is a necessary condition of philosophical thinking, it is not a sufficient condition. Philosophical thinking as taught in the precollege curriculum is characterized as the interplay of dialogue and reflection that has grown out of an initial sense of wonder.

Sebeok, Thomas A. "Six species of signs: some propositions and structures," *Semiotica, 13* (3), pp. 233-260. [EJ 127 813]

Deals with the relationship existing between the signifier and the signified components of signs, and with problems in the definition of signs. It is also concerned with recognizing the relationship of semiotics to developmental psychology and ethology.

Siegel, Marjorie. "Toward an understanding of reading as signification," [1983] 40 pp. [ED 246 388]

To explore how readers create textual meanings or interpretations from written materials, a study that investigated reading from a semiotic perspective was conducted. The

study's design was based on the principle of prior ethnography and employed data collection techniques common to field studies: participant/intervention and interviewing. Field work was conducted over a seven-month period in one fourth-grade classroom. The primary heuristic was an instructional strategy lesson, introduced after a three-month period of prior ethnography, that called on readers to sketch their interpretations of materials read. The lessons and interviews were audio- and video-taped, detailed field notes were kept, and all sketches were collected. Data analysis was focused on three dimensions: the interrelationship of fieldworker and respondents, the contextual constraints and resources in operation during the lessons, and the drawings that were created. Findings suggested that the children's interpretations were influenced by their embedded theories of the social situation, their skills as artists, and the nature of the activity of sketching. Within-class friendships and interests also played major roles in the process of constructing meaning. Overall, results suggested that from the theoretical and methodological perspective of semiotics it is more efficacious to view reading as more than mere representation, that models of direct instruction be reconsidered, and that the potential that transmediation across sign systems holds for curriculum development be explored.

Weaver, Constance. "Parallels between new paradigms in science and in reading and literary theories: An essay review," *Research in the Teaching of English, 19* (3), October 1985, pp. 298-316. [EJ 323 366]

Explores parallels between new paradigms in the sciences, particularly quantum physics, chemistry, and biology, and new paradigms in reading and literary theory, particularly a socio-psycholinguistic, semiotic, transactional view of reading, and a transactional view of the literary experience.

Examples of entries indicating the implications and applications of new perspectives on thinking

Gladwin, Hugh. "In conclusion: abstraction versus 'How It Is.'" *Anthropology and Education Quarterly, 16* (3), Fall 1985, pp. 207-213. [EJ 326 107]

These concluding remarks to a symposium, "The Social Organization of Knowledge and Practice," focus on the high aptitude of persons in everyday situations to solve problems and make decisions. Addresses three questions: 1) What happens when a problem-solver reaches a situation involving calculation? 2) How does learning transfer take place? and 3) Why is school so different from daily life?

Kuhn, Deanna. "Education for thinking," *Teachers College Record, 87* (4), Summer 1986, pp. 495-512. [EJ 336 865]

The educational system has not been particularly successful in teaching thinking skills. In order to do so, it is necessary to identify what thinking skills are and understand their development. Research, its design, and the problem of transfer are discussed.

Lewis, Clayton, and Mack, Robert. "The role of abduction in learning to use a computer system." Paper presented at the Annual Meeting of the American Educational Research Association, 1982. 11 pp. [ED 225 544]

New users learning to use text-processing systems, especially those who are using self-study materials without expert supervision, must often make sense of actions and events in situations where they have little basis, in prior knowledge or current information, for inferring what is happening or why. Many cases have been observed where learners were

able to generate an explanation to account for some particular fact or event, despite this limited knowledge. This process of explanation generation resembles abductive reasoning, as C. S. Peirce describes it: adopting a hypothesis when it, along with other assumptions, allows one to account for some fact or observation. This paper presents examples of how new users try to account for their experiences and the resemblance of these processes to abductive reasoning. Observations are also made about the possible role and implications of abductive reasoning for complex learning situations, such as learning to use a text-processor.

Marksberry, Mary Lee. "Sizing up assertions," *Elementary School Journal*, 76 (5), 1976, pp. 289-295. [EJ 138 525]

Discusses the development of young children's ability to distinguish between warranted and unwarranted assertions in various kinds of communication. Includes examples of home and classroom techniques for building this critical thinking skill.

Matthews, Dorothy, (Ed.) "On teaching critical thinking, cognitive strategies for teaching: poetry, short story, composition, the research paper, critical reading," *Illinois English Bulletin*, 73 (3), Spring 1986. [ED 267 447; not available from EDRS.]

Exploring a variety of ways to train students to think critically within the context of writing and literature classes, this journal issue presents cognitive strategies for teaching poetry, short stories, composition, the research paper, and critical reading. The titles of the articles and their authors are as follows: 1) "Constructing the Critical View" (Randall Stiffler); 2) "Bringing the Burger to Saigon" (Sue Howell); 3) "Listing and Clustering: A Strategy for Teaching Categorizing" (Gerald Grunska); 4) "Using Original Surveys to Promote Thinking in Library Research Projects" (Leigh Henson); 5) "Cognitive Strategies to Use with Basic Writers" (Sallyanne H. Fitzgerald); 6) "Two Strategies for Combining Thinking and Writing" (Lucille C. Bruch); 7) "Teaching Critical Thinking Across the Curriculum: Notes from a Traveling Writing Teacher" (Dora Tippens); 8) "Teaching the Critical Analysis" (Marsha C. Bryant); 9) "The Logic in Mystery" (Jay Fox and Mike Rusniak); 10) "Verbalizing Nonverbal Knowledge" (Deborah H. Pickering); 11) "Sensitizing Students to Nonverbal Language" (Patrick L. McKiernan); and 12) "A Critical Pursuit of Cues: Introducing Semiotics" (James Fulcher).

McCormick, Kathleen. "Improving student thinking at the community college." One of a series of "Essays by Fellows on Policy Issues at the Community College," 1987, 19 pp. [ED 284 608]

Many current attempts to teach critical thinking, including unstructured Piagetian thinking exercises, the Socratic method, and structured courses focusing on either domain-specific skills or general skills to be applied across the curriculum, have not produced the desired result. Various research models, focusing on artificial intelligence; comparisons of expert and novice information processing; logical biases responsible for some systematic errors in logic; and the self-referent effect offer insight into the complicated process of human thought. Using these insights, a program, course, or testing technique may be developed.

McPeck, John. "Stalking Beasts, but swatting flies: The teaching of critical thinking," *Canadian Journal of Education*, 9 (1), Winter 1984, pp. 28-44. [EJ 295 695]

Shows how confusion of the notion of "critical thinking" with such notions as "reasoning ability" and "argument analysis" frequently justifies programs in critical thinking. Discusses critical thinking in everyday problems. Outlines strategy to develop critical

thinking capacities using the philosophy and knowledge of traditional disciplines instead of abstract reasoning skills.

Monighan, Patricia. "The development of symbolic expression in preschool play and language." Paper presented at the 69th Annual Meeting of the American Educational Research Association, 1985. 52 pp. [ED 259 834]

Theoretical correspondences between the language and play development of young children and developmental aspects of play and speech are discussed prior to a report of a study comparing categories of cognitive complexity nested within social categories of solitary play and self-speech. Results substantiate the view that categories of social play and social speech do not form hierarchical levels of development. The frequency of solitary play decreased significantly with age. A significant increase across age groups was found for group play. Interestingly, parallel play increased from age 3 to 4 and decreased from 4 to 5 years, suggesting that parallel play may be a formative context for the child's growing discrimination between private and social aspects of psychological functioning. Both solitary play and self-speech showed developmental changes for cognitive categories. Implications of the findings for development and educational practices are discussed.

Munby, Hugh. "What is scientific thinking?" A discussion paper, D-82/1. Ottawa, Ontario: Science Council of Canada, 1982. 44 pp. [ED 218 139]

If the meaning of the terms "thinking critically" or "thinking scientifically" is not clear, these phrases will become vacuous slogans beyond translation in teaching methods and curriculum materials. Therefore, the fundamental aspect of these terms must be embraced in the discourse of science teaching itself. Suggesting that scientific thinking (or critical thinking in science) is more than puzzle-solving and logic-wielding and avoiding a detailed philosophical and psychological treatise on the nature of thinking, some examples of what appears to pass for thinking are presented. The nature of scientific knowledge is then considered to build some ideas about what it means to hold scientific knowledge, the essential points illustrated with extracts from science teaching.

Murtaugh, Michael. "The practice of arithmetic by American grocery shoppers," *Anthropology and Education Quarterly*, 16 (3), Fall 1985, pp. 86-192. [EJ 326 104]

Presents and analyzes data on the arithmetic procedures people use when shopping for groceries in American supermarkets. Reports that the way shoppers solve problems is closely related to the way they formulate problems: Supermarket arithmetic does not begin with a well-defined problem that calls for a specific numerical answer.

Newton, Richard F. "Inquiry: Science and pedagogy in conflict," *Teachers College Record*, 77 (1), 1975, pp. 107-121. [EJ 136 998]

Points out the flaws inherent in the hypothetico-deductive formulation of inquiry.

Paul, Richard W. "The Socratic spirit: An answer to Louis Goldman," *Educational Leadership*, 42 (1), September 1984, pp. 63-64. [EJ 306 676]

Responding to Goldman's critique of the Socratic method, the author redefines the "Socratic spirit" as rational dialogue focused on questions of significance in an atmosphere of mutual support and cooperation. Exemplified in Lipman's "Philosophy for Children," this approach nourishes the reflective spirit in children and develops their confidence.

Purves, Alan C., and Niles, Olive (Eds.) *Becoming Readers in a Complex Society. Eighty-Third Yearbook of the National Society for the Study of Education, Part I.* Chicago: University of Chicago Press, 1984. [ED 276 977]

Intended to give attention to instruction in reading in the middle grades and beyond, this yearbook includes the following essays: 1) "The Challenge to Education to Produce Literate Citizens" (Alan C. Purves and Olive S. Niles); 2) "The Role of Print as a Medium in Our Society" (Charles Suhor); 3) "The Context of Literacy in Our Society" (Jerome C. Harste and Larry J. Mikulecky); 4) "Unity in Reading" (Kenneth S. Goodman); 5) "Reading Strategies for Expository and Literary Text Types" (Richard Beach and Deborah Appleman); 6) "On Becoming a Thoughtful Reader: Learning to Read like a Writer" (P. David Pearson and Robert J. Tierney); 7) "Planning the Reading Program" (Harold L. Herber and Joan Nelson-Herber); 8) "Resources and Their Use for Reading Instruction" (Jeanne S. Chall and Sue S. Conard); 9) "The Development of Effective Teaching" (H. Alan Robinson and Kathleen Schatzberg); and 10) "Evaluation and Secondary Reading Programs" (Roger Farr and Robert L. Wolf).

O'Reilly, Kevin. "Teaching critical thinking in high school U.S. history," *Social Education, 49* (4), April 1985, pp. 281-284. [EJ 316 047]

U.S. history is an ideal subject for inculcating skepticism and teaching critical thinking. High school students who read and analyze rival interpretations of history come to expect that there is more than one viewpoint to most historical topics. Sample lessons are presented.

Ross, E. Wayne, and Hannay, Lynne M. "Practicing critical theory in social studies preservice education." Paper presented at the 67th Annual Meeting of the American Educational Research Association, 1986. 22 pp. [ED 273 540]

Examines potential reasons for the lack of influence that reflective inquiry has had on social studies theory and suggests an alternative perspective: 1) the interpretation of the inquiry model itself, which entails contradicting conceptions of Dewey's model such as the technical/procedural approach that has become rarefied with the steps of inquiry themselves emphasized over the process and 2) the generally traditional practices of preservice teacher education, which hinge on the premise that teacher educators, while advocating reflective inquiry, do not practice this approach by example and do not furnish a laboratory where such practice is modeled, experienced, and reflected upon. A third section advocates the need to adopt a critical theory perspective in social studies education by exploring what a preservice program based on a critical theory of education might contain, emphasize, and encourage.

Scribner, Sylvia. "Knowledge at work," *Anthropology and Education Quarterly, 16* (3), Fall 1985, pp. 199-206. [EJ 326 106]

Activity theory posits that culturally organized actions guide the acquisition and organization of knowledge. This theory was applied to the organization of knowledge within a large milk processing plant. It was found to be organized by social knowledge, yet individuals creatively synthesized several domains of knowledge to organize their actions.

Solomon, Gavriel, and Perkins, D. N. "Transfer of cognitive skills from programming: When and how?" New York: John and Mary R. Markle Foundation and Washington, D.C.: National Institute of Education, [1985]. 20 pp. [ED 271 092]

Arguing that the most widespread argument in favor of the teaching of programming concerns its possible impact on generalizable cognitive skills, this paper addresses the "how" of transfer. The outlines of a theory of the mechanisms of transfer are used to examine the contrasts between certain studies that did and did not obtain positive transfer results from programming. Two roads to transfer (high and low) and six broad categories of transfer that might occur with programming are described: mathematical and geometric concepts and principles. It is concluded that although programming instruction can improve cognitive skills under the right conditions, implementing such conditions on a wide scale may be difficult, and programming will have to compete in the intellectual and economic markets with a number of other approaches to the same general problem.

Suhor, Charles. "Semiotics. Factsheet." Urbana, Illinois: ERIC Clearinghouse on Reading and Communication Skills, 1982. 3 pp. [ED 234 339]

Semiotics, the study of signs, is a relatively new and highly controversial area. Symbols, icons, and indexes represent the three types of signs. Semantics, pragmatics, and syntactics represent the three basic semiotic areas, with pragmatics having a growing influence in oral language and reading. A comprehensive view of curriculum is implicit in semiotics insofar as all existing school subjects—and even subjects not yet formulated—are ways of organizing signs. The range of semiotics and its potential for organizing thinking about curriculum in new ways can add structure and substance to arguments for the things that teachers value: 1) oral language; 2) the written word; 3) the arts; 4) interdisciplinary study; and 5) the articulate exchange of ideas and feelings among students.

Thomas, Ruth (Ed.) *Higher Order Thinking: Definition, Meaning and Instructional Approaches.* Washington, D.C.: Home Economics Education Association, 1987. 79 pp. [ED 287 998]

This publication shares current thinking, research, and practice in the area of higher order thinking skills with home economics educators. Articles included are: "Introduction" (Ruth Pestle); "Can Higher Order Thinking Skills Be Taught? By What Strategies?" (Jeanette Daines); "Gender as a Variable in Teaching Thinking" (Edna Anderson); "The Role of Listening, Reading, and Writing in Higher Order Thinking: Implications for Home Economics Instruction" (Cheryl Fedje); "The Role of the Future Homemakers of America Student Organization in Facilitating the Development of Critical Thinking Skills" (Wendy Way); "Critical Thinking: Phenomenological and Critical Foundations" (Francine Hultgren); "Problem Solving: Definition and Meaning" (Janet Laster); "Instructional Strategies for Teaching Practical Reasoning in Consumer Homemaking Classrooms" (Janet Laster); "Reflective Thinking: Meaning and Implications for Teaching" (Norma Bobbitt); and "The Meaning of Higher Order Thinking and Its Implementation in Home Economics Education" (Ruth Thomas).

Witucke, Virginia. "Learning to think/thinking to learn: A bibliographic guide," *Top of the News*, 37 (1), Fall 1980, pp. 29-36. [EJ 237 093]

Describes 18 pre-1980 books on thinking and learning for elementary school children. Each book is critically discussed and evaluated in an appropriate category—problem-solving, the scientific method, observation, or logic.